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MELBOURNE AUSTRALIA

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Comarge Research Fellow at Museum Victoria.
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abstract
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contents (only if the paper is extensive)
introduction
main text
acknowledgements
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index (only if extensive)
tables within the text

- Author's **email addresses** in contact details should be in brackets.
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- **Abbreviation** of River and Island/s: Use R for River. Use I for Island and Is. for Islands.
- For **numbers, use numerals except** when used in text narrative when they should be spelt out, but only up to and including the number ten. Numerals should also be spelt out when used as follows: first, second, third, fourth, tenth, twentieth etc.
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  Paulin, C.D. 1986. A new genus and species of morid fish from shallow coastal waters of southern Australia. *Memoirs of Museum Victoria* 47: 201–206.

  Last, P.R., and Stevens, J.D. 1994. *Sharks and rays of Australia*. CSIRO Publishing: Melbourne. 513 pp.

  Wilson, B.R., and Allen, G.R. 1987. Major components and distribution of marine fauna. Pp. 43–68 in: Dyne, G.R. and Watson, D.W. (eds), *Fauna of Australia Volume 1A General articles*. Australian Government Publishing Service: Canberra.
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- **Supplementary information** (extended lists of material examined, databases etc) should be submitted separately and with the final manuscript to be forwarded to referees. The Editorial Board encourages use of supplementary information to minimise the cost of printing as long as the requirements of the International Code of Zoological Nomenclature are met in the printed paper.

Contents

Special Issue, the first of two parts of Volume 66 2009

A special issue in honour of Dr Gary C.B. Poore, Principal Curator of Marine Biology, Museum Victoria

This special issue of *Memoirs of Museum Victoria* is dedicated to Dr Gary C. B. Poore. Gary's interest in taxonomy began whilst working as an ecologist for the (then) Fisheries and Wildlife Department, investigating benthic macrofaunal communities in Port Phillip Bay near Melbourne. Although Gary's career has primarily been in the field of crustacean systematics, his ecological studies, commencing in 1969, remain highly significant. His papers on the benthos of Port Phillip Bay were one of the first such quantitative and multidisciplinary studies undertaken anywhere in the world. These studies and the collections on which they are based are still held in Museum Victoria and represent an ecological snapshot of the benthos of Port Phillip Bay and have provided a vital baseline to subsequent studies.

It was, however, the early realisation that the fauna Gary was studying as an ecologist, contained a high proportion of undescribed species that set the direction for the remainder of his career and Gary set about describing animals and writing keys and guides to the southern Australian crustacean fauna. When Gary commenced at Museum Victoria as Curator of Crustacea in 1979, the collection consisted of only a few trays of specimens. The shelves of the embryonic Crustacean Department held little more than Hale's 1927 book *The Crustaceans of southern Australia* along with a few reprints of Jerry Barnard's papers on the 'Amphipoda of Australia' written in the late 60s and early 70s. Three decades on and the crustacean systematics library is now a vast collection, with few authors represented who are not known personally to Gary. Gary is the author and contributor of more than 100 taxonomic and ecological papers and 40 books describing in excess of 350 species. Of equal importance Gary has built up a world class crustacean collection at Museum Victoria of 60,000 lots which has been made available for taxonomic research world wide.

The publication of this special issue is timed to coincide with Gary's retirement from his position of Principal Curator of Marine Biology on 5 November, 2009. This date marks the 40th anniversary of Gary working in the field of marine science in Australia and it is his 65th birthday. The invited contributing authors of this issue include some of his past and present research assistants, honours and PhD students, Postdoctoral Research Fellows, International Research Fellows, colleagues and friends. These are just a few of the many and varied researchers who have collaborated with Gary and have had their careers initiated or enhanced under his guidance.

We hope that Gary enjoys this special issue. The variety of crustacean taxa included—isopods amphipods, cumaceans, carideans, stomatopods and thalassinideans—is a permanent reminder of Gary's interest across diverse crustacean taxa. Many genera and species are named in his honour and one in honour of his wife Lynsey, whose enthusiastic support of Gary's crustacean research over many decades has benefited all members of the Marine Invertebrate department of Museum Victoria.

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Dr Robin Wilson
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Museum Victoria

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Victoriasquilla poorei, a new genus and species of mantis shrimp from southern Australia, and a range extension for *Hadrosquilla edgari* Ahyong, 2001 (Crustacea: Stomatopoda: Nannosquillidae)

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Abstract

Ahyong, S.T. 2009. *Victoriasquilla poorei*, a new genus and species of mantis shrimp from southern Australia, and a range extension for *Hadrosquilla edgari* Ahyong, 2001 (Crustacea: Stomatopoda: Nannosquillidae). *Memoirs of Museum Victoria* 66: 1–4.

Victoriasquilla poorei, a new genus and species of nannosquillid stomatopod from southern Australia is described. *Victoriasquilla poorei* appears to be most closely related to species of *Austrosquilla*, especially *A. osculans* (Hale, 1924), with which it shares a similar rostral plate, a similar complement of antennal papillae, similar raptorial claw armature, and telson and uropod structure. *Victoriasquilla poorei* also superficially resembles the eastern Atlantic *Nannosquilloides occulta* (Giesbrecht, 1910), but differs in numerous features including fusion of the ocular scales, the number of ventral papillae on the antennal protopod, size of the epipod of maxilliped 5, the armature of the basal segment of the pereopods and posterolateral margin of AS6, and the absence of a 'false eave' on the telson. New distributional records of *Hadrosquilla edgari* are also reported.

Keywords Crustacea, Stomatopoda, Nannosquillidae, *Victoriasquilla*, *Hadrosquilla*, Victoria, Australia

Introduction

The Australian stomatopod fauna currently stands at 148 species in 14 families (Ahyong, 2001, 2008; Ahyong *et al*., 2008). Nannosquillidae is represented by six genera in Australia, of which only *Austrosquilla* Manning, 1966 (6 species) and *Hadrosquilla* Manning, 1966 (2 species), both southern Australian endemics, occur in temperate waters. Examination of unidentified material in the collections of Museum Victoria, not accessible at the time of the Ahyong (2001) revision of the Australian Stomatopoda, revealed the presence of an undescribed species and genus from Victoria, along with first records of *Hadrosquilla edgari* Ahyong, 2001 from mainland Australia. The new species and new genus are described herein, and new records reported.

Materials and Methods

Terminology and size descriptors follow Ahyong (2001). All measurements are in millimetres (mm). Total length (TL) is measured along the midline from the tip of the rostral plate to the apices of the submedian teeth. Carapace length (CL) is measured along the midline and excludes the rostral plate. The Propodal Index (PI) of the raptorial claw is given as 100CL/propodus length. The Propodal Length-Depth Index (PLDI) of the raptorial claw is given as 100 times propodus length/propodus depth. Specimens are deposited in the collections of Museum Victoria, Melbourne (NMV).

Nannosquillidae Manning, 1980

Victoriasquilla gen nov.

Diagnosis. Cornea subglobular. Rostral plate with single anterior median projection. Antennal protopod with 2 mesial and 1 ventral papillae. Mandibular palp absent. Maxillipeds 1–5 with epipod. Raptorial claw dactylus with 8 teeth; ischium unarmed. Abdominal somite 6 with posterolateral spines; sternum unarmed. Telson dorsal surface with posteromedian projection, otherwise unarmed; 'false-eave' absent; margins with movable submedian teeth, intermediate and lateral primary teeth, and four intermediate denticles.

Etymology. Derived from a combination of the Australian state name, Victoria, and the generic name *Squilla*. Gender feminine.

Type species. *Victoriasquilla poorei* gen. et sp. nov.

Victoriasquilla poorei gen. et sp. nov.

Figure 1

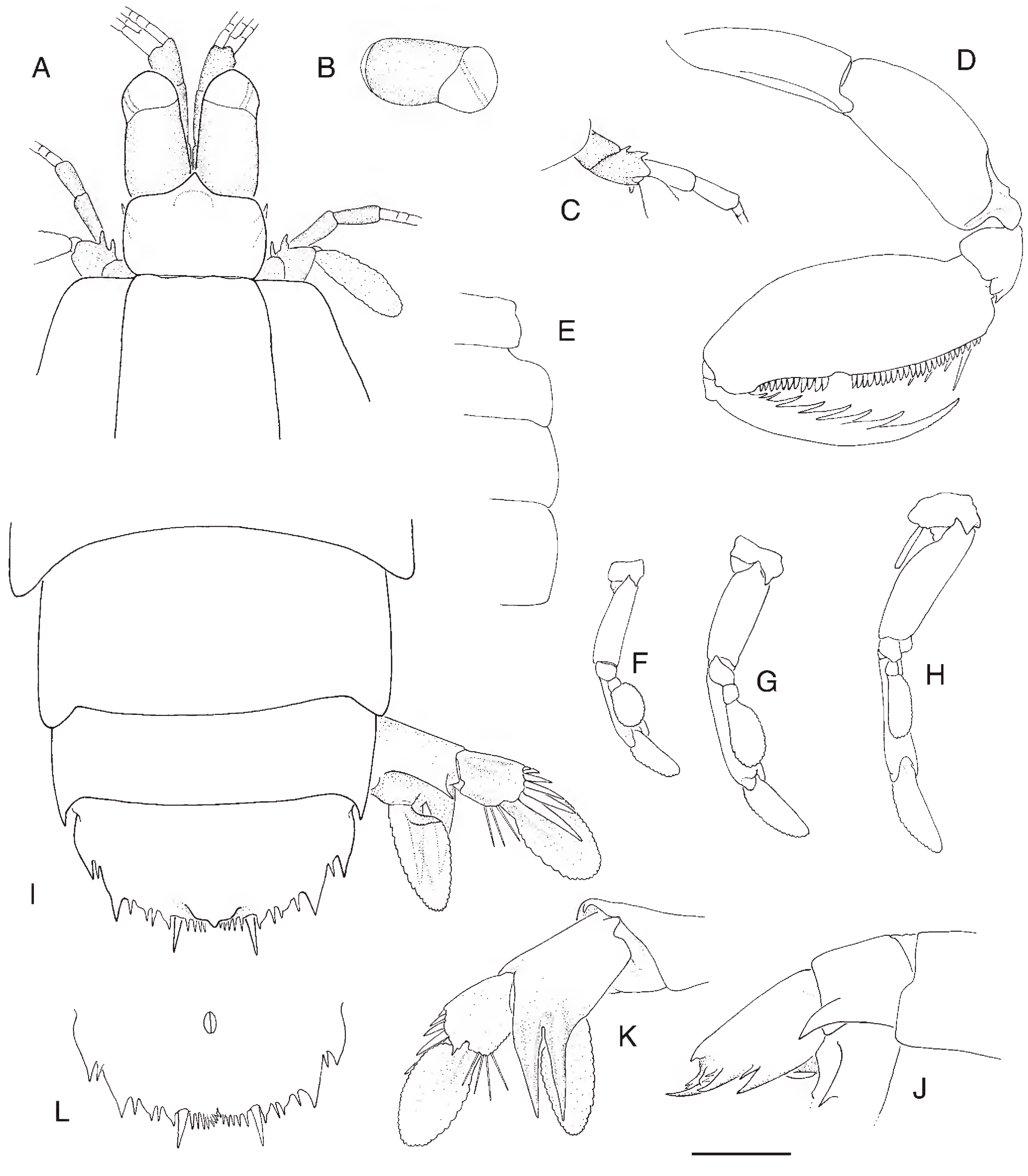

Figure 1. *Victoriasquilla poorei* gen et sp. nov., male holotype, TL 17 mm (NMV J53108). A, anterior cephalothorax. B, right eye, lateral view. C, right antennal protopod, lateral view. D, right raptorial claw, lateral view. E, thoracic somites 5–8, right dorsal view. F–H, right pereopods 1–3, respectively, posterior view. I, posterior abdomen, telson and right uropod, dorsal view. J, posterior abdomen and telson, right lateral view. K, right uropod, ventral view. L, telson, ventral view. Scale 1.0 mm

Type material. Holotype: NMV J53108, male (TL 17 mm), Horn Point, North Shore, Wilsons Promontory, Victoria, 39°01'36"S, 146°28'12"E, shallow subtidal, rotenone, WPNPA stn 44, R. Kuiter and M. McDonald, 8 Feb 1982.

Description of holotype. Eye with cornea subglobular, oriented slightly obliquely on stalk; extending slightly beyond midlength of antennular peduncle segment 3. Ophthalmic somite anterior margin rounded. Ocular scales fused into broad, subtruncate lobe, about twice as wide as long.

Antennular peduncle 0.52CL. Lateral spines of antennular somite slender, directed anterolaterally, not reaching anterior margin of rostral plate. Antennal protopod with 1 ventral papilla and 2 mesial papillae; antennal scale 0.30CL, margins fully setose.

Rostral plate subquadrate, wider than long, lateral margin broadly convex, anterolateral and posterolateral corners rounded; anterior median projection triangular; dorsal and ventral surfaces smooth.

Raptorial claw dactylus with 8 teeth; outer margin convex, with small proximal lobe. Propodus shorter than carapace; occlusal margin pectinate, proximally with 4 movable spines; PI 115, PLDI 255. Carpus with small dorsal distal spine, otherwise unarmed. Merus and ischium unarmed, former slightly longer than latter.

Mandibular palp absent. Maxillipeds 1–5 each with epipod; fourth and fifth epipod subequal.

Thoracic somites 6–8 lateral margins subtruncate to broadly rounded. Thoracic somite 8 sternal keel obsolete.

Pereopods 1–3 each with pointed, triangular lappet on outer posterior margin of basal segment; endopods 2-segmented, subcircular to ovate.

Abdominal somite 6 smooth, unarmed dorsally; posterior margin smooth; posterolateral spine prominent; sternum surface and posterior margin unarmed; small, curved ventrolateral spine anterior to uropodal articulation.

Telson wider than long; with 2 pairs of fixed primary teeth (intermediate and lateral); with 6–8 submedian denticles either side of midline forming shallow inverted V-shaped row; with 4 spiniform intermediate denticles in same plane; with 1 spiniform lateral denticle. Dorsal surface smooth, with trapezoid posteromedian projection bearing short median tooth overhanging innermost submedian denticles.

Uropodal protopod with 2 straight, ventrally carinate primary spines, inner slightly longer than outer; inner margin of protopod unarmed adjacent to endopod articulation; dorsal spine prominent, sharp. Exopod proximal segment outer margin with 5 or 6 straight, graded movable spines, distalmost exceeding midlength of distal segment; inner distal margin with 4 stiff setae; distal margin with short ventral spine. Exopod distal segment ovate, with low median carinae. Endopod with median dorsal sulcus.

Colour. Faded in alcohol.

Measurements. TL 17 mm, CL 3.50 mm, antennular peduncle length 1.83 mm, antennal scale length 1.06 mm. Raptorial claw propodus length 3.04 mm, height 1.19 mm.

Etymology. It is a pleasure to name this species for Gary Poore, in recognition of his major and longstanding contributions to carcinology, especially that of southern Australia.

Habitat. The precise habitat and sampling depth of the holotype of *V. poorei* were not recorded at the time of collection, but it was at SCUBA depths, probably shallower than 15 m (T. O'Hara pers. com.). According to Museum Victoria records, other species collected at the same station include the decapod shrimps *Alpheus australosulcatus* Banner & Banner, 1982, *A. parasocialis* Banner & Banner, 1982, *Philocheras victoriensis* (Fulton & Grant, 1902) and *Rhynchocinetes australis* Hale, 1941, along with numerous shallow water inshore fish species.

Remarks. Based on Ahyong (2001), *Victoriasquilla* gen. nov. will key out to the eastern Atlantic *Nannosquilloides* Manning, 1977, sharing similar armature of the dactylus of the raptorial claw, similar eye and rostral plate shape, absence of the mandibular palp, presence of 5 epipods, and 2 mesial papillae on the antennal protopod, and an unarmed sternal margin of abdominal somite 6. *Victoriasquilla poorei* gen. et sp. nov., however, differs from the type and only species of *Nannosquilloides*, *N. occulta* (Giesbrecht, 1910), in numerous features: 1) the ocular scales are fused instead of separate; 2) one instead of two ventral papillae are present on the antennal protopod; 3) the epipod of maxilliped 5 is subequal to, instead of less than half the size of that of maxilliped 4; 4) the posterior margin of the basal segment of the walking legs bears a broad triangular lappet instead of a pair of slender spines; 5) one instead of two ventrolateral spines are present anterior to the uropodal articulation; 6) the posterolateral margin of abdominal somite 6 is armed; 7) the upper posterior margin of the telson lacks a 'false eave'; and 8) the outer primary spine of the uropodal protopod is subequal to, instead of distinctly shorter than, the inner. Although *Victoriasquilla* and *Nannosquilloides* share a number of taxonomic features, the similarities appear to be superficial. The general facies of *Nannosquilloides*, including the presence of a 'false eave' on the telson, suggests that it is more closely related to *Hadrosquilla* Manning, 1966, and *Nannosquilla* Manning, 1963. In contrast, *Victoriasquilla* appears to be more closely allied to *Austrosquilla*, especially *A. osculans* (Hale, 1924), with which it shares a similar rostral plate, a similar complement of antennal papillae, similar armature on the raptorial claw dactylus and similar telson and uropod structure. *Austrosquilla osculans* itself is aberrant in the genus (see Ahyong, 2001), and might also belong in a different genus.

The holotype of *V. poorei* is a subadult male, so the endopod of pleopod 1 is not yet modified and the penes have not reached full length. The specimen otherwise displays typical adult features. Of the known southern Australian Nannosquillidae, *V. poorei* is similar to *Austrosquilla osculans* (Hale, 1924) (as already noted) and *Hadrosquilla edgari* Ahyong, 2001, in sharing a subquadrate rostral plate with a short median point and 2 mesial papillae on the antennal protopod. *Victoriasquilla poorei* is distinguished from *A. osculans* by lacking the distal ischial spine on the raptorial claw, 5 instead of 4 epipods, and in having a blunt, rather than spinular median projection on the posterodorsal surface of the telson. From *H. edgari*, *Victoriasquilla poorei* is readily distinguished by the absence

of the false-eave on the telson, 5 instead of 4 epipods, presence of more than 7 teeth on the dactylus of the raptorial claw and in having subequal instead of markedly unequal primary spines on the uropodal protopod.

The small size of *V. poorei*, and its general similarity to *Austrosquilla osculans*, which reaches at least 43 mm TL (Ahyong, 2001), means that it could be easily overlooked as a juvenile of the latter species.

Distribution. Presently known only from the type locality, Horn Point, North Shore, Wilsons Promontory, Victoria.

Hadrosquilla edgari Ahyong, 2001

Hadrosquilla edgari Ahyong, 2001: 161–162, (fig. 80) [type locality: Cloudy Bay Lagoon, Tasmania, Australia].

Material examined. NMV J53612, 3 females (TL 26–30 mm), Shoreham, Western Port Bay, Victoria, 38°26'S, 145°03'E, J. A. Kershaw, 30 Mar 1902; NMV J53613, 12 specimens, same; NMV J53614, 1 male (TL 28 mm), same.

Remarks. *Hadrosquilla edgari* was previously known only from Tasmania, so the present records from Victoria confirm that it occurs on both sides of Bass Strait.

Distribution. Tasmania and now from Western Port Bay, Victoria.

Acknowledgements

I wish to thank the organisers of the volume for the opportunity to contribute, and for access to the Museum Victoria collections. Support from the NIWA Capability Fund and the New Zealand Foundation for Research, Science and Technology (CO1X0502) is gratefully acknowledged.

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A new genus of a new Austral family of paratanaoid tanaidacean (Crustacea: Peracarida: Tanaidacea), with two new species.

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Abstract

Błażewicz-Paszkowycz M. and Bamber, R.N. 2009. A new genus of a new Austral family of paratanaoid tanaidacean (Crustacea: Peracarida: Tanaidacea), with two new species.. *Memoirs of Museum Victoria* 66: 1–15.

During analysis of tanaidacean material collected from the Bass Strait, Victoria, Australia, in 1965 and 1974, seven specimens of a new species were found, quite distinct from but showing close affinities to the aberrant Antarctic paratanaoid species *Mirandotanais vorax*. More recent sampling in 2008 on Ningaloo Reef, Western Australia, discovered two specimens of a second new species, showing closer affinity to the Victoria species. Both new species are described herein, and the Australian taxa are separated into a distinct genus owing in particular to the morphology of their mouthparts, with features consistent between the two but quite distinct from Antarctic *M. vorax*. A new family is erected to include both genera.

Keywords Tanaidacea, Australia, *Mirandotanais*, *Pooreotanais*, Mirandotanainae

Introduction

The tanaidacean tanaidomorph genus *Mirandotanais* was erected by Kusakin and Tzareva (1974) for their new and aberrant Antarctic species *M. vorax*, a paratanaoid with many similarities in appearance to *Collettea* Lang, 1973, but with an extravagantly swollen pleon in the adults (this inflation including posterior pereonites). While never common, this species has since been recorded a number of times (see below) in Antarctic and Subantarctic waters, but the genus has remained monotypic.

During examination of the extensive collection of tanaidacean material held in Museum Victoria, Melbourne, from surveys in the Bass Strait between the 1960s and 1990s, seven specimens of a distinct but similar species, with proportionately an even more inflated pleon, were discovered from samples taken in the shallow waters of Western Port, Victoria, including adults of both sexes.

Further, during a survey of Ningaloo Reef, Western Australia, in 2008, two female specimens of a second new species were discovered in coral rubble. This animal was distinct from the species from Victoria, but showing more affinity to that species than to *Mirandotanais vorax*.

These two new species are described herein. Owing to features of their mouthpart morphology, consistent between the two Australian species but quite distinct from the Antarctic one, the two new species are placed in a new genus. The two genera are (re)diagnosed, and assigned to a new family.

Methods

The Bass Strait collections were part of a long programme of sampling in this region, including the overall Bass Strait Survey, together with specific local benthic surveys in the bays and estuaries of Victoria (see Poore, 1986; Wilson and Poore, 1987). The material discussed here was collected during the Crib Point Benthic Survey (CPBS) and the Westernport Bay Environmental Study (WBES), using a Smith-McIntyre grab. Samples were washed in the field through a 1.0 mm mesh sieve, fixed in formalin and subsequently stored in 70% alcohol.

The material from Western Australia was collected during a CReefs (Australia) field-trip organized by the Australian Institute of Marine Science (AIMS) to Ningaloo (mid-western Australia). Pieces of coral rubble were collected by hand during SCUBA-diving, and were placed into buckets (20 l) with a few drops of formaldehyde for a while to encourage any animals to leave their microhabitats, such as tubes or crevices. The samples, with the animals still alive, were then washed over a 0.3 mm mesh, the residue sorted under the microscope and all tanaidacean specimens collected were preserved in 80% ethanol.

Series of specimens of type-genus, *Mirandotanais vorax* was collected during Polish Polar Expedition to *H. Arctowski* Station in 1984/85 (Błażewicz-Paszkowycz and Sekulska-Nalewajko, 2004).

Morphological terminology follows that of Błażewicz-Paszkowycz and Bamber (2007). Measurements are made

axially, dorsally on the body and antennae, laterally on other appendages. The new material is lodged in the collections of Museum Victoria, Melbourne (Bass Strait material), and the Western Australian Museum, Perth (Ningaloo material). The material of *Mirandotanais vorax* is deposited at the collection of University of Łódź.

Systematic Part

Order **Tanaidacea** Dana, 1849
Suborder **Tanaidomorpha** Sieg, 1980
Superfamily **Paratanaoidea** Lang, 1949

Family **Mirandotanaidae fam. nov.**

Diagnosis. Mature adults with strongly-inflated posterior pereonites and pleon ("abdomen") comprising half or more of the body length. Eyelobes prominent, eyes absent. Antennule of four articles, antenna of six articles. Labrum naked or with minute setules; mandible poorly calcified, with reduced *pars molaris*; labium naked; maxillule palp articles fused, with two distal setae; maxilliped basis fused medially. Cheliped basis attached by distinct triangular sclerite; dactylus strongly curved. Pereopods 1 to 3 with a separate coxa, merus naked, carpus and propodus with sparse setae only (no spines); pereopods 4 to 6 coxa not distinct, merus, carpus and propodus with slender spines; dactylus and unguis not fused, unguis of pereopods 4 to 6 distally bifurcate. Pleopods absent in female, biramous with simple, mainly distal, setae, in male. Uropods short, compact, exopod of one segment, endopod of two segments.

Etymology: from the type-genus, *Mirandotanais*.

Remarks. The most recent comprehensive classification of the Paratanaoidea was that of Guţu and Sieg (1999), which placed *Mirandotanais* in the Anarthruridae Lang, 1971. Since that time, a large number of new genera and species have been described, earlier taxa have been redescribed, and there is now a weight of evidence that their familial structure was too simplistic. Subsequent mathematical phylogenetic treatments of the Paratanaoidea by unweighted cladistic analysis have been attempted. Larsen and Wilson (2002) undertook a morphologically-based empirical parsimony analysis using eighty-one exemplar taxa, but failed to resolve a large number of genera into an overall classification. Their results suggested the inclusion of *Mirandotanais* in their new family Colletteidae, although their key would identify it with their other new family Tanaellidae, and some features of the genus were counter to their familial diagnosis for Colletteidae (but, curiously, not their diagnosis of Anarthruridae).

Błażewicz-Paszkowycz and Poore (2008) undertook a similar cladistic unweighted analysis of ninety-three paratanaoid taxa; they were unable to resolve Colletteidae *sensu* Larsen & Wilson (2002), indicating that this taxon is grossly polyphyletic, while *Mirandotanais* was isolated both from taxa associated with "Colletteidae" and from their clearly-resolved group of Anarthruridae; rather, the genus was weakly-associated with *Parafilitanais mexicanus* and *Pseudoleptognathia setosa*, albeit with very low bootstrap support. These taxa are incompatible with such "colletteid" genera as *Subulella*, *Leptognathiella*, *Stenotanais*, *Leptognathiopsis* and *Filitanais* (which did cluster together in the analysis of Błażewicz-Paszkowycz and Poore, 2008) which are characterized by strong "spiniform setae" on pereopods 1 to 3, *inter alia*, while these are absent in *Mirandotanais* and in the new genus described below. The presence of weak setation on the anterior three pairs of pereopods is compatible with some species of *Collettea*, including the type-species *C. cylindrata* (Sars, 1882), but these setae are usually robust (cf. *C. arnaudi* (Shiino, 1979); *C. pegmata* Bamber, 2000).

All taxa in the Colletteidae *sensu* Larsen & Wilson (2002) other than *Mirandotanais* have well-developed mouthparts, with a functional mandible and fully-developed maxilliped, unlike the two genera discussed herein; conversely, reduction of the mouthparts is a characteristic feature of the Anarthruridae, together with weak setation of the anterior three pairs of pereopods. However, current understanding of the Anarthruridae includes only taxa without a uropod exopod (merely some form of apophysis on the uropod basis), unlike the two genera discussed in the present paper.

These characters (if deemed significant-enough to define families) exclude *Mirandotanais* and the new genus described below from either the Colletteidae or the Anarthruridae as presently diagnosed.

Until the familial classification within the Paratanaoidea is properly resolved, it is therefore necessary to assign *Mirandotanais* to a new family, the Mirandotanaidae.

Genus ***Mirandotanais*** Kusakin and Tzareva, 1974

Diagnosis. *Pars incisiva* of left mandible with low crenulations, *pars incisiva* of right mandible without crenulations; small (fused) *lacinia mobilis* present on both mandibles; *pars molaris* a stout, unornamented triangular lobe. Labrum finely setose. Maxillule with nine distal spines. Maxilliped palp article 3 longer than wide, with three inner setae; endite with distal seta. Ischium of pereopods 1 to 3 with ventral seta. Pereopods 4 to 6 with four spines on carpus.

Distribution—Antarctic-Subantarctic.

Type-species. *Mirandotanais vorax* Kusakin and Tzareva, 1974 by monotypy.

Mirandotanais vorax Kusakin and Tzareva, 1974

Strongylura antarctica Hale, 1937; non-Vanhöffen, 1914.
Cryptocopoides rotundata Tzareva, 1982.

Material. All samples from the Admiralty Bay (King George Island, South Shetland Island), six females, OC-477, Section 1, 221 m depth, 11 May 1985; 6 females OC-485, Section 1, 232 m depth, 10 Aug 1985; 1 female, OC-479, Section 1, 240 m depth, 11 May, 1985; 1 female, OC 283, 258 m depth, 23 Jul 1985; 1 female, OC-275, 60 m depth, 10 Dec 1979.

Remarks. *Mirandotanais vorax* has been re-described by Sieg (1984: 299–305, figs. 1, 3–5), although with some apparent confusion over gender. In the light of the Australian material described below, it is apparent that the females of *Mirandotanais* are without pleopods, and the gender-attribution of Kusakin

and Tzareva (1974) was correct. Examination of recent material of this species has shown that the distal spines on the merus and carpus of the posterior three pairs of legs are simple, and rod-shaped, not sharp as figured by Sieg (*loc. cit.*).

Kusakin and Tzareva (*loc. cit.*) suggested that the "strongly dilated abdomen" and mandible structure were indicative of a parasitic mode of life, but there has been no further evidence to support this contention. Indeed, tubicoly has been inferred by Sieg (1986b), which would imply a non-parasitic mode of life.

M. vorax is a circum-Antarctic species, not common, but recorded frequently (Hale, 1937, as *Strongylura antarctica*; Kusakin and Tzareva, 1974; Tzareva, 1982, as *Cryptocopoides rotundata*; Sieg, 1984; 1986a [literature]; 1986b [distribution map]; Błażewicz and Jażdżewski, 1996; Schmidt, 1999; Błażewicz-Paszkowycz and Jażdżewski, 2000; Schmidt and Brandt, 2001; Błażewicz-Paszkowycz and Sekulska-Nalewajko, 2004) from a depth range of 10 to 580 m.

Genus *Pooreotanais* gen. nov.

Diagnosis. Pars incisiva of both mandibles with elaborate denticulation; *lacinia mobilis* absent on right mandible, very reduced (fused) on left mandible; *pars molaris* reduced to a small spike. Labrum naked. Maxillule with five to eight distal spines. Maxilliped palp article 3 as wide as or wider than long, with no or one inner seta; endite naked, weakly expanded distally. Ischium of pereopods 1 to 3 naked, carpus with one dorsodistal seta, merus and carpus of pereopods 4 to 6 with two subdistally-bifurcate distal setae.

Distribution—temperate-tropical Australia.

Etymology. Named in honour of Gary Poore of Museum Victoria, in recognition of his outstanding contribution to crustacean taxonomy and phylogeny.

Type species. Pooreotanais gari **sp. nov**. by original designation.

Other species. Pooreotanais ningaloo **sp. nov**.

Remarks. The two new species from Australian waters described herein as members of the new genus *Pooreotanais* show many affinities to the genus *Mirandotanais* in the grossly inflated, "maggot-like" appearance, the morphology of the antennules and antennae, and of the cheliped, pereopods (including their sparse setation and the bifurcate unguis on the posterior three pairs) and uropods. The morphology of the mouthparts, however, is remarkably distinct, particularly that of the mandibles with the long marginal teeth on the *pars incisiva*, the reduced *lacinia mobilis* and *pars molaris*; equally the labrum, maxilliped endite and basis are naked (finely setulose, and with single distal seta respectively in *M. vorax*), the maxilliped palp articles are stouter and more sparsely setose. Other differences in *Pooreotanais* include the cheliped setal row having three setae (four in *M. vorax*), the naked ischium of the anterior three pairs of pereopods, the presence of proximal setal tufts on the dactyli, and the unguis being shorter than the dactylus on the posterior three pairs of pereopods. There are also differences between the genera in the character of the spines on the merus and carpus of pereopods 4 to 6 (bifurcated in *Pooreotanais* and simple in *Mirandotanais*) and their different number on the carpus (four in *Mirandotanais* and two in *Pooreotanais*). Additionally the expanded pleon is proportionately longer in *Pooreotanais* than in *Mirandotanais*.

It is in particular the distinct mouthpart morphology which is considered justification for separating the following two species into a distinct genus.

Pooreotanais gari sp. nov.

Figs. 1–3

Material. Holotype female (J56252), stn CPBS 33S, Western Port, Victoria, 38°22.06'S 145°14.10'E, 13 m depth, on reef with sponge, 5 Mar 1965. Paratypes and allotype: 2 large females, 2 small specimens (J58851), same locality as holotype; 1 large female (J56254), WBES stn 1747, Western Port, Victoria, 38°27.53'S 145°08.59'E, 18 m depth, sand, 25 Nov 1974; 1 large female dissected on slides (J56253); 1 allotype male dissected on slides (J60423), stn CPBS 41N, Western Port, Victoria, 38°20.81'S 145°13.85'E, 13 m depth, gravel and sand, 30 Mar 1965.

Description of female. Body (fig. 1B–D) up to 3.5 mm long, glabrous, generally cylindrical, with cephalothorax and pereonites 1 to 3 slender, pereonites 4 and 5 progressively expanding, pereonite 6 and pleon ("abdomen") grossly inflated; holotype 2.1 mm long, pleon 1.4 mm long. Cephalothorax subrectangular, wider than long, with slight rostrum, eyelobes prominent and eyes absent (fig. 1C–D). Pereonites 1 and 2 shortest, 0.25 times as long as cephalothorax; succeeding pereonites progressively longer, pereonites 3, 4 and 5 respectively 1.4, 2.0 and 3.5 times as long as pereonite 1, pereonite 6 massive, 6.5 times as long as pereonite 1. Pleon of five free subequal pleonites plus pleotelson; each pleonite about 7 times as long as pereonite 1 except pleonite 5 about 5.5 times as long as pereonite 1; pleotelson stout, rounded, 0.7 times as long as last pleonite.

Antennule (fig. 2A) of four articles; proximal article stout, twice as long as wide, 1.2 times as long as distal three articles together, with one simple and five penicillate outer setae in distal half; article 2 just wider than long, 0.3 times as long as article 1, with simple distal outer seta; article 3 about half length of article 2, with simple inner-distal seta; article 4 comparatively slender, 3 times as long as wide and 1.2 times as long as article 2, with three long and one short distal setae and one aesthetasc.

Antenna (fig. 2B) of six articles, proximal article compact, naked; article 2 as long as wide, naked; article 3 as long as wide, with dorsodistal seta; article 4 longest, more than twice as long as article 3, 2.6 times as long as wide, with two inner penicillate setae and two simple distal setae; article 5 0.35 times as long as article 4 with one distal seta; article 6 comparatively minute, one-third length of article 5, with one subdistal and three distal strong setae.

Labrum (fig. 2C) rounded, naked. Left mandible (figs. 2D, D') with eleven elongate teeth distally on *pars incisiva*; *lacinia mobilis* a slight, fused tooth; *pars molaris* a short spike without rugosity; right mandible (figs. 2E, E') with nine distal elongate teeth, without *lacinia mobilis*. Labium (not figured) naked, without palp. Maxillule (fig. 2F) with six distal and two subdistal spines, and sparse microtrichia on inner distal face; palp distinct, unsegmented, with two distal setae. Maxilla (not figured) small, ovoid, naked. Maxilliped (figs. 2G, G') palp article 1 wide, naked; article 2 almost triangular, no outer

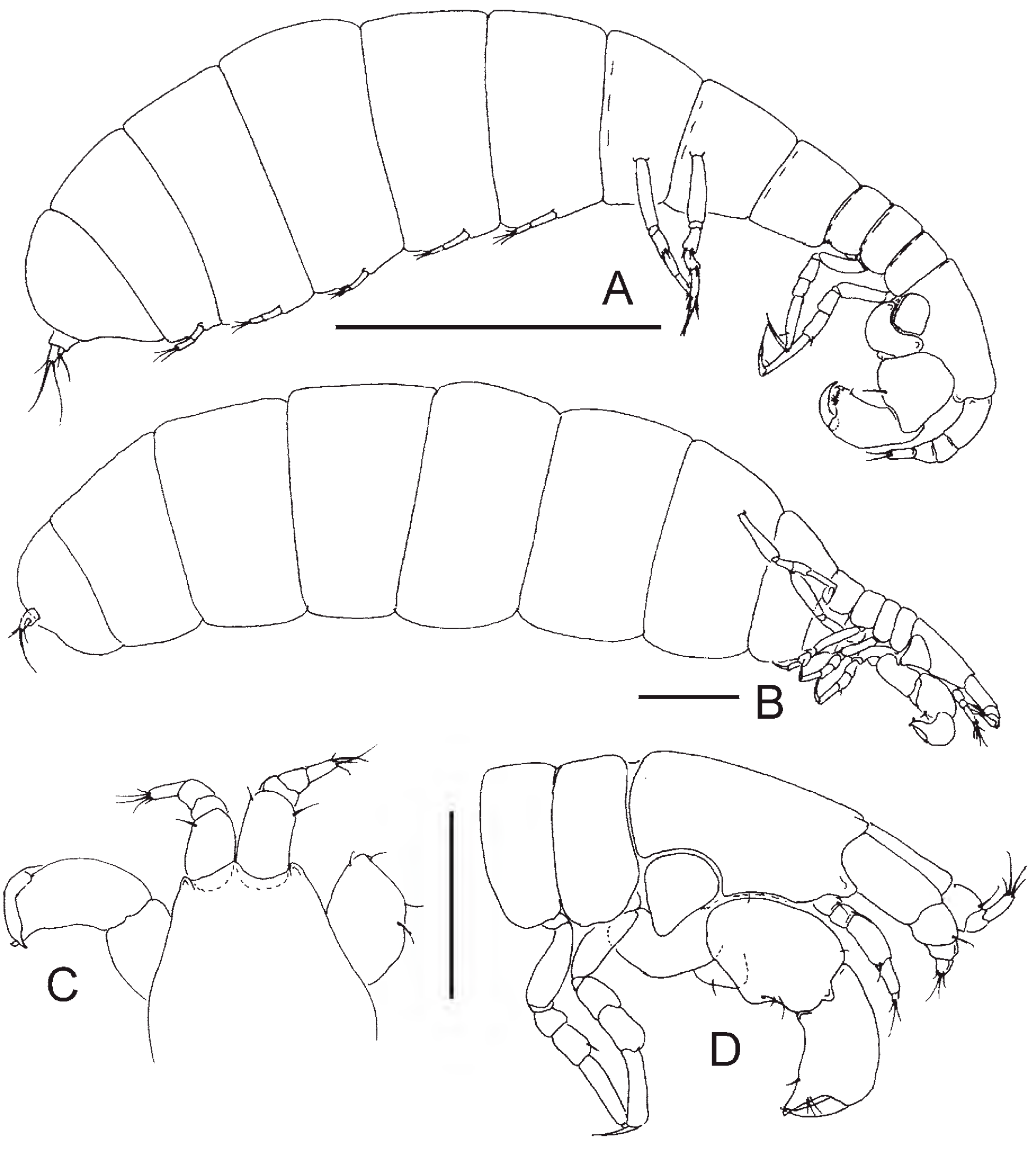

Figure 1. *Pooreotanais gari* gen. et sp. nov., : A, body lateral, male; B, body lateral, female; C, details of anterior part of body in female; D, details of cheliped attachment. Scale line = 0.5 mm for A, 0.2 mm for B, 0.1 mm for C–D.

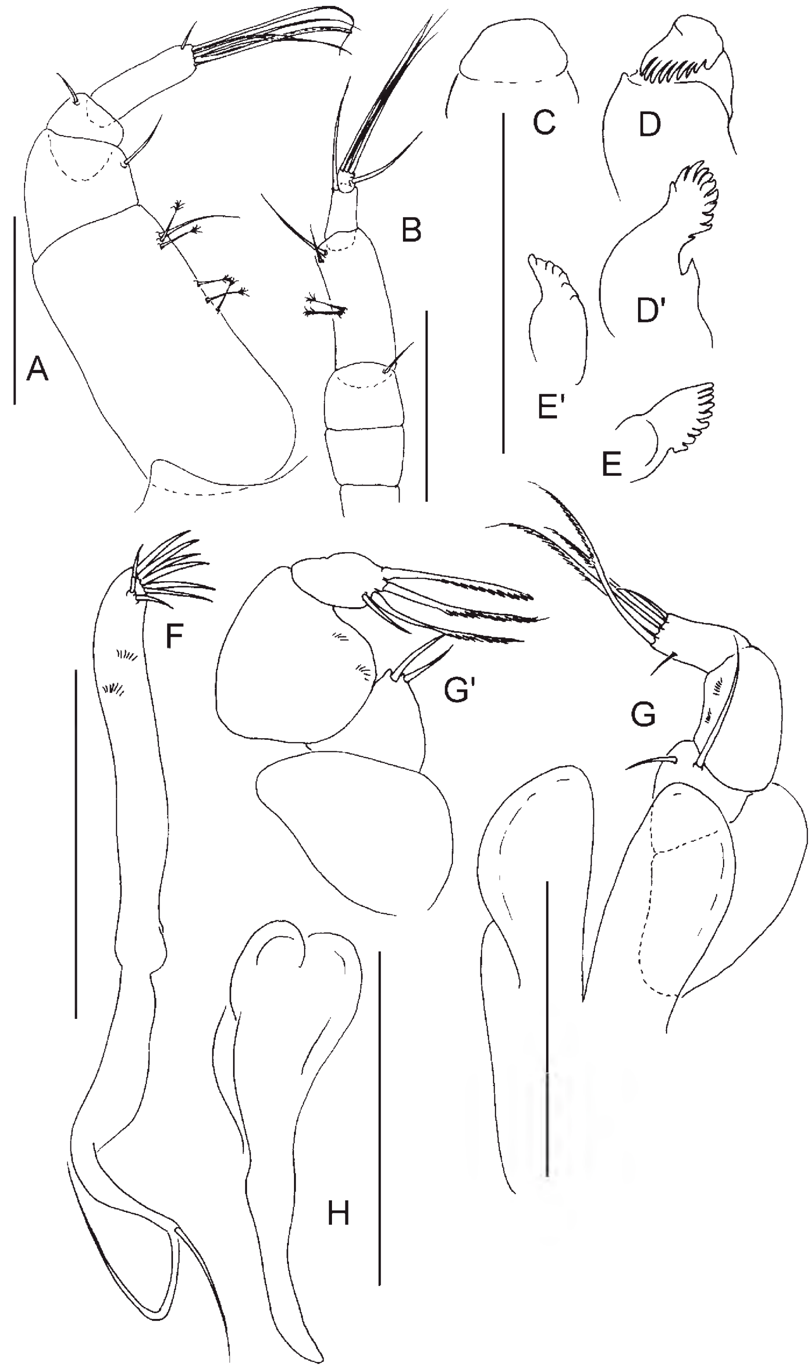

Figure 2. *Pooreotanais gari* gen. et sp. nov., female: A, antennule; B, antenna; C, labrum; D, left mandible, outer aspect; D', left mandible, dorsal aspect; E, right mandible, outer aspect; E', right mandible, dorsal aspect; F, maxillule; G, Maxilliped; G', maxilliped palp, outer-ventral aspect; H, epignath. Scale lines = 0.01 mm.

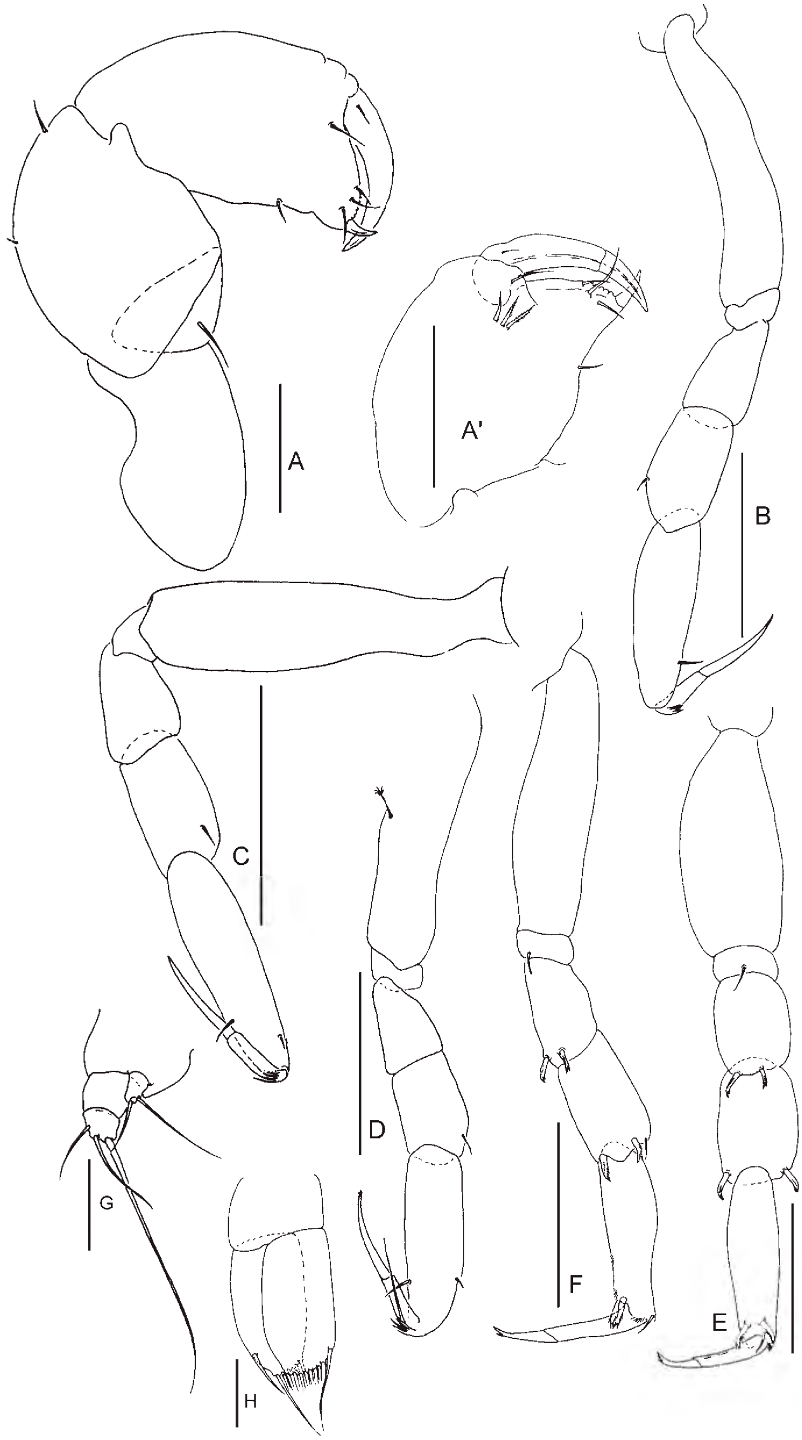

Figure 3. *Pooreotanais gari* gen. et sp. nov., female: A, cheliped; A', chela inner face; B, pereopod 1; C, pereopod 2; D, pereopod 3; E, pereopod 5, ventral; F, pereopod 6; male: G, uropod; H, pleopod Scale lines = 0.1 mm for A–A', 0.01 mm for B–H.

setae, two simple inner setae, distal-most inner seta exceeding distal margin of palp article 3; article 3 as wide as long, with no inner or outer setae, sparse inner submarginal microtrichia; article 4 with single subdistal simple seta and four distal setae minutely denticulate in their distal half; basis naked; endites large, naked. Epignath (fig. 2H) elongate, tapering from bilobed anterior, naked.

Cheliped (figs. 3A, A') robust, with rounded, elongate basis about twice as long as wide; merus subtriangular with one ventral seta; carpus just longer than wide, with fine mid-dorsal seta, longer dorsodistal seta, but no ventral setae; propodus longer than wide, with one ventral seta, cutting-edge of fixed finger almost perpendicular to axis of propodus, fixed finger with one proximal and three distal outer setae, cutting edge minutely crenulated distally, inner setal row at base of dactylus of three setae; dactylus with proximal outer seta only.

Pereopod 1 (fig. 3B) coxa naked; basis slender, 5.2 times as long as wide, naked; ischium compact, naked; merus shorter than carpus, naked; carpus with one dorsal subdistal seta; propodus almost as long as carpus and merus together, with single ventral subdistal seta; dactylus slender with dorsoproximal setal tuft, extending into longer slender unguis, the two together some 0.75 times as long as propodus. Pereopod 2 (fig. 3C) similar to pereopod 1, but propodus with two subdistal setae. Pereopod 3 (fig. 3D) similar to pereopod 2, but basis with penicillate seta, dactylus with one longer seta in proximal setal tuft.

Pereopods 4 and 5 (fig. 3E) identical to each other, basis stouter than on anterior pereopods, 3.9 times as long as wide, naked; ischium with one ventrodistal seta; merus and carpus subequal, merus with two minutely denticulate, subdistally bifurcate ventrodistal spines; carpus with fine outer distal seta and two minutely denticulate, subdistally bifurcate ventrodistal spines; propodus with three minutely denticulate ventrodistal spines and adjacent simple seta; dactylus and unguis not fused, unguis shorter than dactylus, distally bifurcate. Pereopod 6 (fig. 3F) as pereopod 5, but propodus bearing distal marginal microtrichia and only two minutely denticulate ventrodistal spines.

Pleopods absent.

Uropod as in male.

Description of male. Similar in appearance to but smaller than female (fig. 1A) (allotype length 1.72 mm), pleon 0.55 times total body length; cephalothorax 4 times as long as each of subequal pereonites 1 to 3, pereonite 4 expanded, twice as long as pereonite 1, pereonite 5 three times as long as pereonite 1, pereonite 6 just shorter than pereonite 5. Inflated pleonites each bearing pair of pleopods.

Antennule, antenna, mouth part, cheliped and pereopods the same as in female.

Pleopods (fig. 3H) biramous; exopod twice as long as wide with nine setae distally; endopod little shorter than exopod with one inner seta and 6 setae distally. All setae simple.

Uropod (fig. 3G) compact, biramous, basis wide and naked; exopod of one segment, half as long as proximal endopod segment, with one shorter and one longer distal setae; endopod of two segments, proximal segment as wide as long, naked, distal segment little shorter than proximal segment, with three distal setae.

Etymology. Named in honour of Gary Poore (noun in apposition), in gratitude for all his assistance to both authors over many years—and for originally introducing us.

Pooreotanais ningaloo sp. nov.

Figs 4–5

Material. Holotype female (Reg WAM 42784), NIN 14C, Ningaloo Reef front, south of Tintabiddy, Western Australia, 21° 54.505'S 113° 57.963'E, small and medium rubble in gully, 10 m depth, 15 June 2008. Paratype: 1 female dissected on slides, 2.1 mm long, (Reg WAM 42785), NIN 5C, Ningaloo Reef, Western Australia, 21° 52.942'S 113° 58.367'E, dead head of coral, 4–5 m depth, 7 June 2008.

Description of female. Body (fig. 4A) glabrous, generally cylindrical, with cephalothorax and pereonites 1 to 6 slender, pereonite 6 expanded, and pleon ("abdomen") grossly inflated; holotype 2.27 mm long, pleon 1.7 mm long (0.75 times the length of the whole body). Cephalothorax subrectangular, wider than long, with slight rostrum, eyelobes and eyes absent. Six free pereonites; pereonite 1 shortest, 0.24 times as long as cephalothorax; pereonites 2, 3, 4 and 5 subequal in length, 2.75 times as long as pereonite 1, pereonite 6 expanded, twice as long as pereonite 5. Pleon of five free subequal pleonites plus pleotelson, all expanded; pleonites progressively longer, pleonite 1 about 1.5 times as long as pereonite 6 to pleonite 5 twice as long as pereonite 6; pleotelson stout, rounded, 1.3 times as long as last pleonite.

Antennule (fig. 4B) of four articles; proximal article stout, 1.7 times as long as wide, just shorter than distal three articles together, with one simple outer distal seta; article 2 just longer than wide, 0.5 times as long as article 1, with single distal inner and outer setae; article 3 half length of article 2 with single distal inner and outer setae; article 4 comparatively slender, three times as long as wide and 0.7 times as long as article 2, with six distal setae and one aesthetasc.

Antenna (fig. 4C) of six articles, proximal article compact, naked; article 2 as long as wide, with dorsodistal seta; article 3 wider than long, 0.75 times as long as article 2, with dorsodistal seta; article 4 longest, twice as long as article 2, twice as long as wide, with distinct indication of pseudoarticulation at mid-length, coincident with one penicillate seta, distally with three penicillate and three simple setae; article 5 half as long as article 4 with one long distal seta; article 6 comparatively minute, one-quarter length of article 5, with one subdistal and three distal strong setae.

Labrum (fig. 4D) rounded, naked. Left mandible (fig. 4F) with eight triangular teeth distally on *pars incisiva*; *lacinia mobilis* a slight, fused tooth; *pars molaris* not seen; right mandible (fig. 4E) with five distal triangular teeth, without *lacinia mobilis*. Labium (not figured) naked, without palp. Maxillule (fig. 4G) endite with five distal spines; palp distinct, unsegmented, with two distal setae. Maxilla (fig. 4G) small, ovoid, naked. Maxilliped (fig. 4H) palp article 1 naked; article 2 subrectangular, no outer setae, one simple inner seta; article 3 almost as wide as long, with one stout inner simple seta;

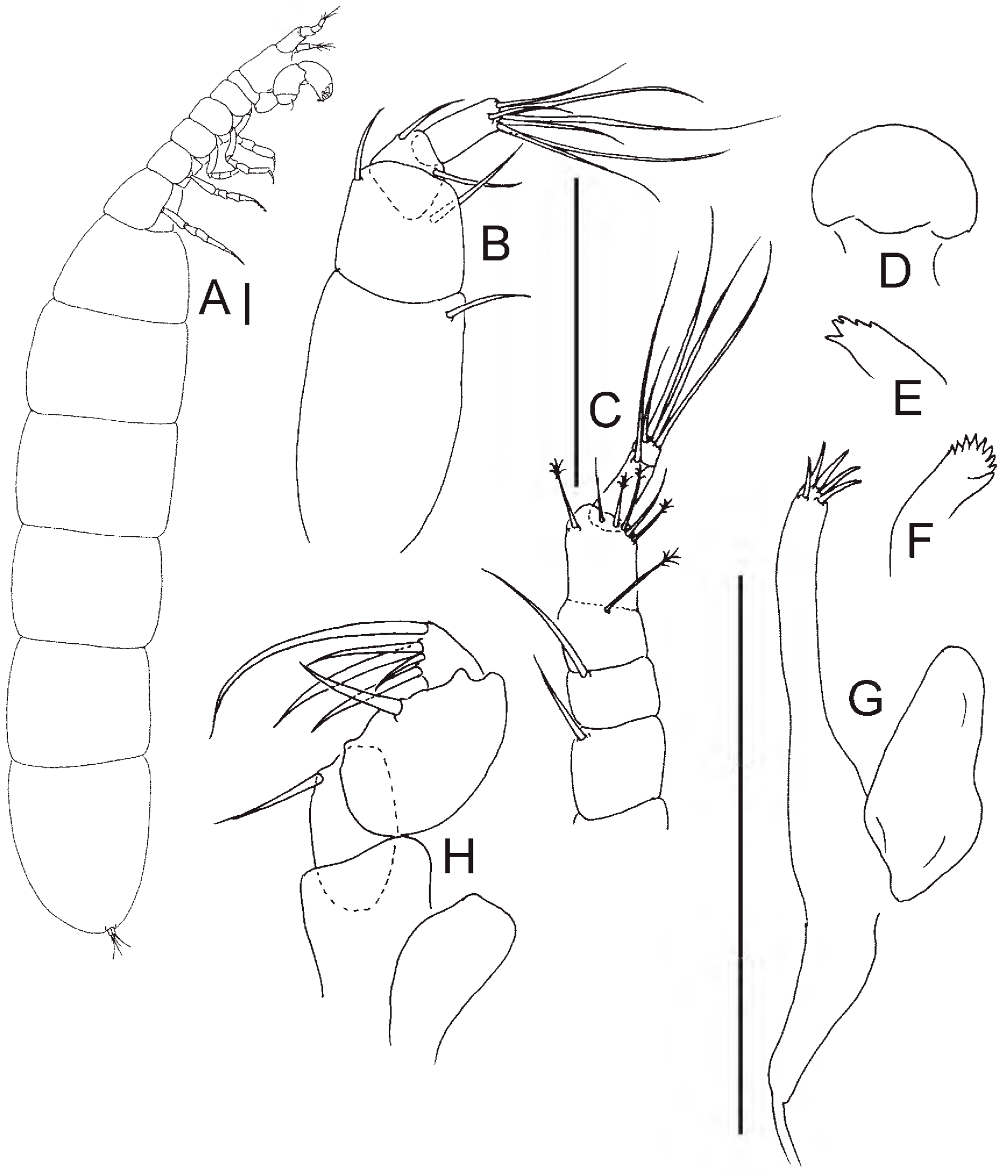

Figure 4. *Pooreotanais ningaloo* gen. et sp. nov., female: A, body laterally; B, antennule; C, antenna; D, labrum; E, right mandible incisor; F, left mandible incisor; G, maxillule and maxilla; H, maxilliped. Scale lines = 0.1 mm.

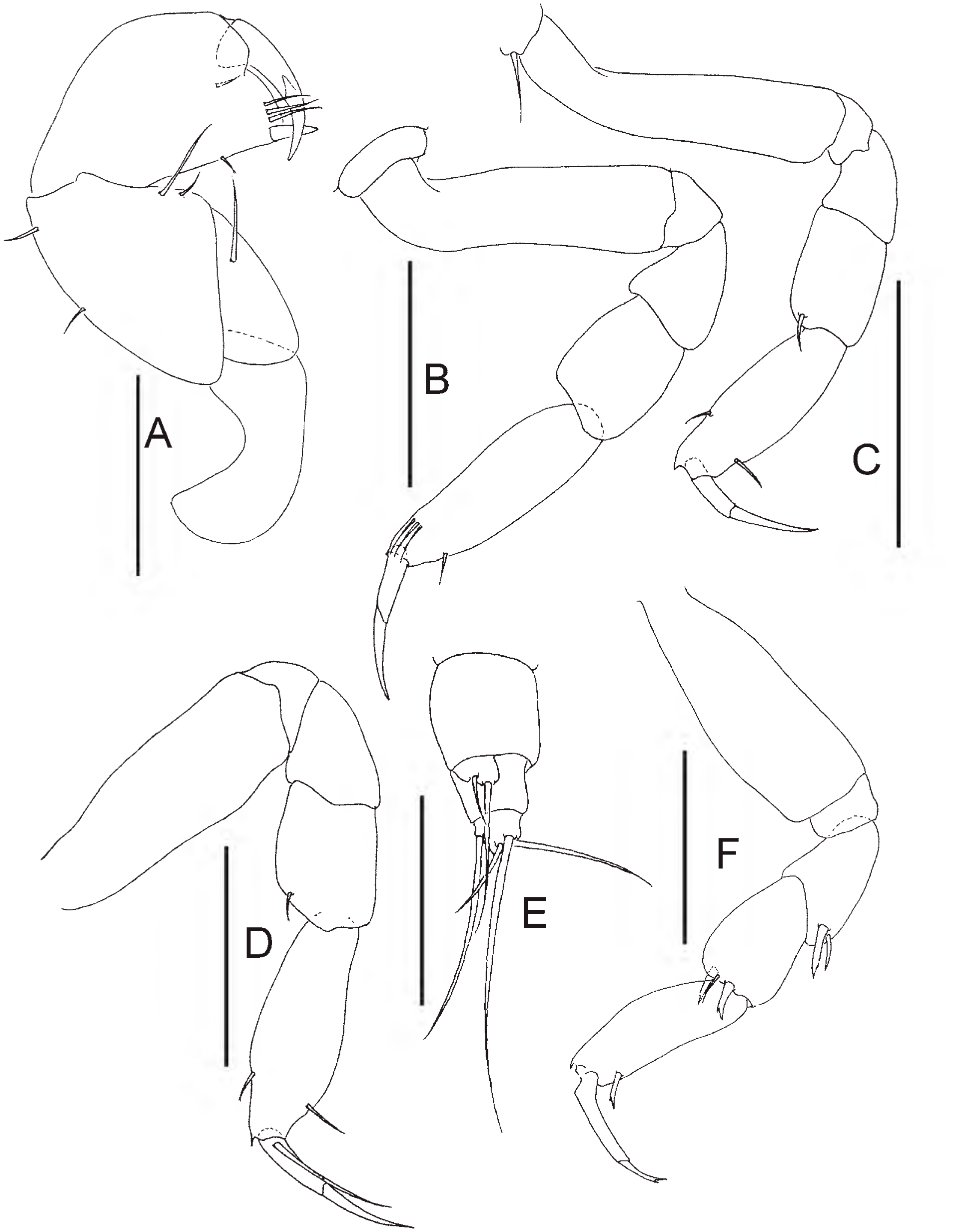

Figure 5. *Pooreotanais ningaloo* gen. et sp. nov., female: A, cheliped outer side; B, pereopod 1; C, pereopod 2; D, pereopod 3; E, uropod; F, pereopod 5. Scale lines = 0.1 mm

article 4 with one shorter and four longer simple distal setae; basis naked; endites large, naked. Epignath not seen.

Cheliped (fig. 5A) robust, with rounded, elongate basis just less than twice as long as wide; merus subtriangular with one ventral seta; carpus just longer than wide, with mid-dorsal seta and dorsodistal seta, and two ventral setae; propodus longer than wide, with one ventral seta, cutting-edge of fixed finger almost perpendicular to axis of propodus, fixed finger with three distal outer setae, cutting edge minutely crenulated distally, inner setal row at base of dactylus of one seta; dactylus naked.

Pereopod 1 (fig. 5B) coxa naked; basis slender, 3.8 times as long as wide, naked; ischium compact, naked; merus shorter than carpus, both naked; propodus longer than carpus and merus together, with single ventral subdistal seta and three dorsodistal setae; dactylus slender, naked, extending into subequal curved unguis, the two together some 0.6 times as long as propodus. Pereopod 2 (fig. 5C) similar to pereopod 1, but coxa with a seta, carpus with one dorsodistal seta, propodus dorsally with one subdistal seta. Pereopod 3 (fig. 5D) similar to pereopod 2, but dactylus with one long proximal seta.

Pereopods 4 and 6 missing.

Pereopod 5 (fig. 5F) basis stouter than on anterior pereopods, 2.8 times as long as wide, naked; merus and carpus subequal, merus with two minutely denticulate, subdistally bifurcate slender ventrodistal spines; carpus with fine outer distal seta and two minutely denticulate, subdistally bifurcate curved ventrodistal spines; propodus with one minutely denticulate ventrodistal spines; dactylus and unguis not fused, unguis less than half as long as dactylus, distally bifurcate.

Pleopods absent.

Uropod (fig. 5E) compact, biramous, basis as wide as long, naked; exopod of one segment, half as long as proximal endopod segment, with one shorter and one longer distal setae; endopod of two segments, proximal segment wide than long, naked, distal segment 0.6 times as long as proximal segment, with four distal setae.

Male: unknown.

Etymology. Named after Ningaloo Reef, the type-locality (noun in apposition).

Remarks. *Pooreotanais ningaloo* sp. nov. shows the same features of the coarsely denticulate mandibular incisor and other mouthpart morphology, leg setation and proportionate length of expanded pleon as *P. gari*, and as listed in the diagnosis of the genus, to which it is accordingly attributed, and by which it is comfortably distinguished from *Mirandotanais vorax*.

The present species is equally distinct from *P. gari* on a number of features: the pereonites 4 and 5 are not expanded, but the inflated pleon contributes three-quarters of the body-length (two-thirds in *P. gari*); the pleotelson is longer than any pleonites (shorter in *P. gari*); the articles of the antennule and antenna are more compact, and the pseudoarticulation of the antennal article 4 is not found in *P. gari*; there are fewer distal spines on the maxillule endite, fewer teeth on the mandibular incisor, fewer inner setae on the maxilliped palp article 1, conversely one inner seta on the article 2 (none in *P. gari*); there are also subtle differences in the (sparse) setation of the cheliped and pereopods.

Discussion

The three species discussed above show a consistent but aberrant morphology in the extreme inflation of the pleon, including to some degree the posterior pleonites. A proportionately overlarge and cylindrical pleon is also found in *Cetiopyge* Larsen & Heard, 2002, *Collettea* Lang, 1973 and *Filitanais* Kudinova-Pasternak, 1973, although only the first of these genera shows such gross inflation (albeit laterally compressed), the pleon of the other two rather being uniformly cylindrical with the pereon and cephalothorax. These genera also show a similar morphology of the reduced, stout uropods, of the number and proportions of antennular and antennal articles (although *Cetiopyge* has a small fifth antennule article), and of the reduced setation of the maxilliped, the cheliped and (other than *Cetiopyge*) the pereopods. Other than the structure of the pars molaris, *Collettea* and *Filitanais* also have a similar mandibular morphology to *Mirandotanais vorax*, although not to either species of *Pooreotanais*.

The discovery of two further species in the family Mirandotanaidae sheds no further light on the reasons for their unusual gross morphology. Their habitats range from coral and coral rubble, to sand and muddy sand, without any suggestion of common sympatric taxa which may offer a food resource or a host; while the inference of tubicoly from Sieg's (1986b) material (see above) conflicts with Kusakin and Tzareva's (1974) idea of parasitism, the dactyli and ungues of the pereopods 1 do not appear adapted for secretion for tube-building, being hardly different from those of pereopods 2 or 3.

When considering possibly analogous morphologies outside the Tanaidacea, gnathiid isopods (and termites!) develop a grossly-inflated "abdomen" for the development of eggs in the female, but this is not the case in these tanaidaceans, as the same morphology is shown by the mature male (and tanaidacean gonads extend through the pereon as well). Equally, the pleon inflation is not shown by the juvenile stages (e.g. Kusakin and Tzareva, 1974: fig. 1.4; Sieg, 1984: fig. 3), so it is a feature of sexual maturity. Sieg (1986b) found 52 "brood-pouch embryos" of *Mirandotanais vorax* with a female in an Antarctic sample at 60-90 m depth, implying a comparatively high fecundity for a tanaidomorph tanaidacean, so maximized gamete production may be the reason for the inflated pleon. If this were the case, histological examination of the gonads/gametes of a mature male (and in comparison with, for example, a male *Collettea*) would prove most revealing.

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This paper is dedicated to Gary Poore.

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Acutiserolis poorei sp. nov. from the Amundsen and Bellingshausen Seas, Southern Ocean (Crustacea, Isopoda, Serolidae)

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Abstract

Brandt, A. 2009. *Acutiserolis poorei* sp. nov. from the Amundsen and Bellingshausen Seas, Southern Ocean (Crustacea, Isopoda, Serolidae). *Memoirs of Museum Victoria* 66: 17–24.

Acutiserolis poorei sp. nov., is described from the Amundsen and Bellingshausen Seas, Southern Ocean. Comparison with the type material of the most similar species, *Acutiserolis spinosa* (Kussakin, 1967) revealed that *A. poorei* may be distinguished from *A. spinosa* by broader eyes, less acute and slightly shorter coxal plates and the small tubercles that are irregularly scattered on the dorsal surface. Additionally, no suture divides the fifth coxal plate and the head has a prominent mediocaudal spine reaching to the middle of the third pereonite; the *appendix masculina* is considerably shorter than that of *A. spinosa*, while the pleotelson of *A. poorei* is covered with some small tubercles and the mediocaudal tip is slightly more prominent than that of *A. spinosa*.

Keywords taxonomy, Isopoda, Serolidae, new species, Acutiserolis poorei, Southern Ocean

Introduction

The first significant change from the simplistic serolid taxonomy was the establishment of several new genera by Brandt (1988) including *Acutiserolis*. This was recently revised by Poore & Storey (2009) and *Cuspidoserolis* Brandt, 1988 synonymised with *Acutiserolis*. Poore & Storey (2009) presented an updated and extensive generic diagnosis.

A new species has been sampled in the Amundsen and Bellingshausen Seas, faunistically a yet unknown area of the Southern Ocean, from onboard of the British RV *James Clarke Ross*. It is described in the present paper.

Material and methods

During the BIOPEARL II (BIOdiversity, Phylogeny, Evolution and Adaptive Radiation of Life in Antarctica) expedition in 2008 with RV *James Clarke Ross* (JR 179, for location data see Kaiser et al., 2009), megabenthic fauna from the shelf of the Amundsen and Bellingshausen Seas was sampled using an Agassiz trawl fitted with a net of mesh size 1 cm. All specimens of the species described here came from approximately 1500 m depth.

The sampled fauna was fixed in 96% ethanol. In the laboratory, megabenthic isopods of the BIOPEARL 2 expedition were kept in ethanol permanently and dissected, identified and illustrated using a Leica MZ12 stereomicroscope equipped with a camera lucida.

Abbreviations used in text and figures:

A1, 2—antennula, antenna; Hy,—hypopharynx; lMd, rMd,—left and right mandible; Mp,—mandibular palp; Mx1, 2,—maxillula, maxilla; Mxp,—maxilliped; P1–7,—pereopods 1–7; Plp1–5,—pleopods 1–5; urp,—uropods

Taxonomy

Sphaeromatidea Wägele, 1989

Serolidae Dana, 1853

Genus *Acutiserolis* Brandt, 1988

Acutiserolis Brandt, 1988: 21; 1991: 131, 139.— Poore & Storey, 2009: 2–9.

Cuspidoserolis Brandt, 1988: 23-24.— Brandt, 1991: 131, 138–139—. Wägele, 1994: 52, 59–60.

Serolis (*Acutiserolis*). –Wägele, 1994: 53, 60. Not *Acutiserolis*. –Poore & Brandt, 1997: 152–160 (= *Brucerolis* Poore & Storey, 2009).

Type species. *Acutiserolis spinosa* (Kussakin, 1967) (Brandt, 1988 by original designation).

Generic remarks. The genus diagnosis of *Acutiserolis* Brandt, 1988 had been referred to by Poore and Brandt in 1997 and recently been revised by Poore and Storey (2009) who have designated *Cuspidoserolis* to be a junior synonym of *Acutiserolis*. As Poore and Storey provided a very extensive

generic diagnosis of *Acutiserolis*, their concept is followed here except for the fact that pereonite 6 is dorsally not fused with 7 and pleonite 1 because in *A. poorei* at least a suture line of the segment is clearly visible.

Acutiserolis poorei **sp. nov. (figs. 1–4)**

Holotype. Female of 24 mm length, 13.03.2008, RV *James Clarke Ross*, Amundsen Sea, Pine Island Bay slope, 71°15'S 109°98'E, 1515–1530 m depth, ZMH-K 42212.

Paratypes. male of 28 mm length, female of 22 mm length (laterally partly damaged), and female (damaged after pereonite 3, anterior part only), 27.02.2006, RV *James Clarke Ross*, Bellingshausen Sea, northwest of Alexander Island, 68°38'S 75° 87'E, 1469–1497 m depth ZMH-K-42213; female of 24 mm length, two Manca II of 19 mm each, 13.03.2008, RV *James Clarke Ross*, Amundsen Sea, Pine Island Bay slope, 71°15'S 109°97'E, 1515–1530 m depth, ZMH-K-42214.

Diagnosis. Head with long mediocaudal acuminating spine reaching mid of third pereonite in dorsal view. Eyes 0.3 as broad as long, dorsal side of body with scattered tubercles on all pereonites, pleonites and pleotelson. Tips of coxal plates not quite as acute, but shorter and less curved coxal plates laterally to their pereomers. The coxal plates were directed caudally to a larger extent than in the type species. Pereonites 6 and 7 not fused mediodorsally or medioventrally. Uropods inserted within proximolateral caudally directed notch (smaller and less distinct than in the type species). Male *appendix masculina* twice as long as endopodite (possibly the male is subadult). Pleotelson covered with some small spine-like tubercles and caudally rounded, mediocaudal tip is slightly acute (slightly more than that of *A. spinosa*).

Distribution. Amundsen Sea and Bellingshausen Sea.

Etymology. Named after Gary Poore, who loves to work with Serolidae and related species. Besides being a very good isopodologist he is a very good friend.

Description of female holotype (fig. 1) and paratype (fig. 2): Anterolateral angles of head slightly elongate laterally (fig. 1); head frontally slightly narrower than mediocaudally. Two shallow rounded elevations on head, sculptured by small concave and small convex structures, a mediocaudal spine reaching mid of third pereonite. Body surface irregularly covered with tubercles (only illustrated on pleotelson). Sixth coxal plate longest, slightly less than half as long as the length of the animal, measured from head to pleotelson. The epimera of the second and third pleonites do not reach as far back as the apex of the sixth coxal plate, and also do not surpass the pleotelson (they reach about two thirds of pleotelsonic length), first pleonite with slightly longer epimera than second. Pereonite 7 small, without coxal plates. Pereonites 2–4, and 7 with caudolateral small spines, strongest and most pronounced in pereonite 7, pleonites 2 and 3 also with caudolateral small spines. Pleotelson with one long elevated medial keel and proximolateral triangular elevations on each side of this keel, tips caudally directed. Pleotelson with two small shallow frontolateral spines and small spines and tubercles scattered on dorsal surface. Tip of pleotelson slightly acuminating (fig. 1).

A1 of paratype female (fig. 2): second peduncular article about twice as long as first one, third one longest, first and second article with small feather-like seta. 47 flagellar articles; first flagellar article longest. From flagellar articles 15 to last but one article one aestetasc each and 1–3 long simple setae. Last flagellar article without aesthetasc, but with 6 simple setae and one feather-like seta.

A2 of paratype female (fig. 2) with 19 flagellar articles. First peduncular article very short; second peduncular article slightly longer than third without setae; third article with few mediodistal and lateral short setules; fourth peduncular article little shorter than fifth, but slightly broader, with several longitudinal rows of groups of 5–7 simple setae; fifth peduncular article also with groups of setae. All 20 flagellar articles with groups of 1–4 distolateral simple setae and one on opposite side.

P2 of paratype female (fig. 2) basis bearing three feather-like setae, and long ischium with only distal simple setae. Merus 0.5 of ischium and 0.9 of carpus, carpus with some ventral simple setae and some distodorsal ones. Propodus proximally as broad as distally. Ventrally the propodus bears rows of long simple setae. Dactylus 0.4 as long as propodus, with short dorsal setules, a short and small claw.

Additional description of paratype male (figs 1–4).

Mandibles of paratype male (fig. 2): Pars incisiva of rMd narrower than of left. Lacinia mobilis of rMd much smaller and narrower than pars incisiva, one tooth accompanied by a small, similarly long blunt, spine-like structure, pars molaris lacking. First palp article as broad as second, second one longest (slightly longer than first), with a distolateral row of more than 27 spines. Last article shortest and laterally bent, with a ventral row of smooth spines (detail in fig. 2). Pars incisiva of lMd (fig. 2) 1.2 as broad as of rMd, with broad cutting surface and one shallow incision, lacinia mobilis with one broad surface and accompanied by a single spine (rudiment of the spine row), pars molaris absent.

Lateral endite of Mx1 of paratype male (fig. 2) distally curved medially, apically with 10 strong cuticularized teeth. Medial endite small rudiment, with one short apical seta.

Mx2 of paratype male (fig. 2): Inner endite with many slender setae, median endite with two long setae, outer endite also with two long setae: setae of median and outer endite setulated at tips (detail in fig. 2).

Mxp of paratype male (fig. 2) with large quadrangular epipodite, strong endite, 1.3 as long as epipodite. Endite apically with two strong spines, no coupling hooks present, but mediolateral surface of endite covered with simple setules and setae. Palp usual.

P1 of paratype male (fig. 3): Basis to merus without any spines or setae, carpus with two strong sensory spines. Mediolateral surface of propodus with one long row of sensory spines, the sensory seta divides the spine distally. Alternating to these sensory spines shorter and broader ones occur, which are densely covered with small setules and which also bear a sensory seta with a distal pore. Dactylus with small and short dactylar claw.

P2 of paratype male (fig. 3) with long basis and ischium, ischium with few simple setae. Merus and carpus about subequal in length with some ventral simple setae and some distodorsal

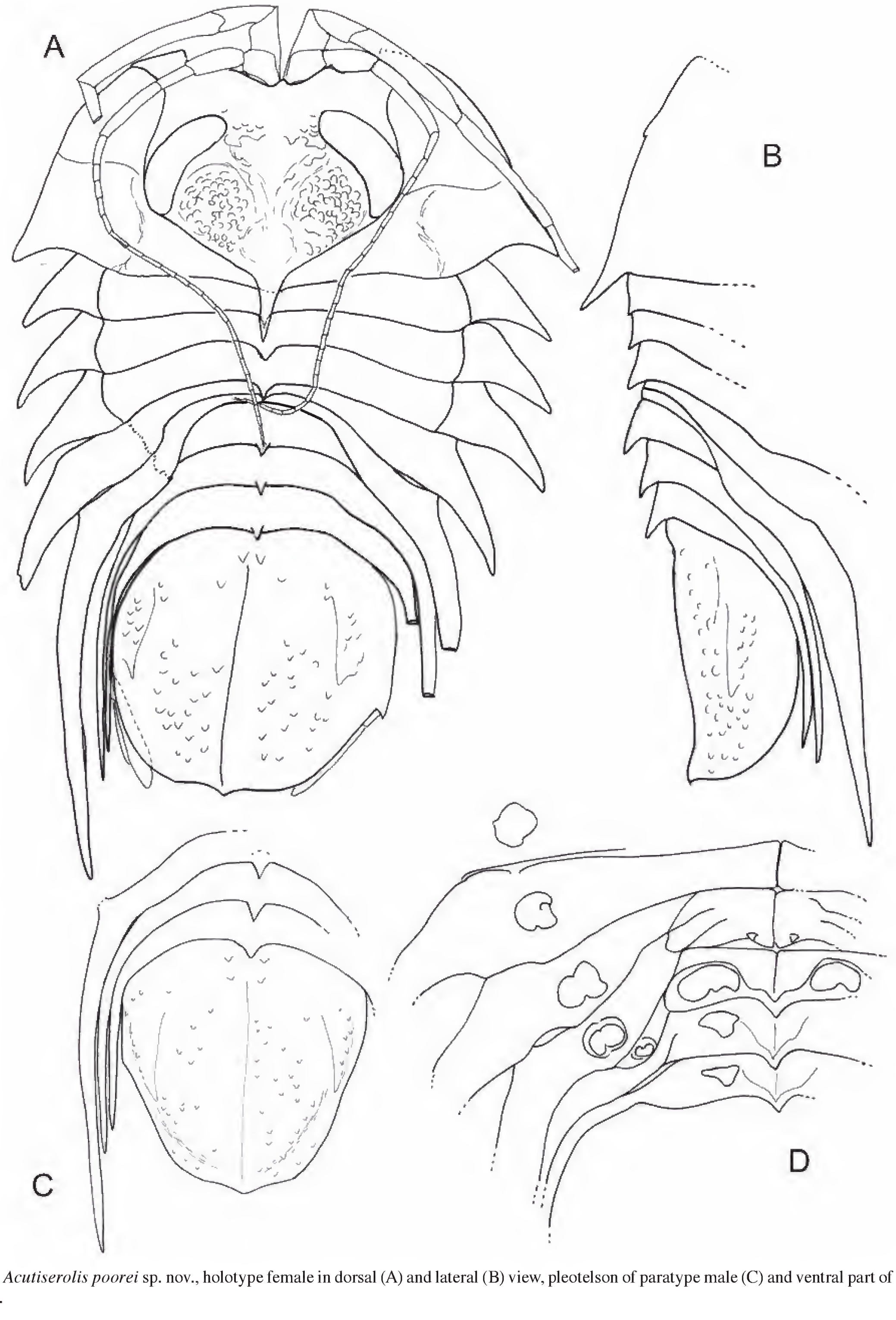

Figure 1. *Acutiserolis poorei* sp. nov., holotype female in dorsal (A) and lateral (B) view, pleotelson of paratype male (C) and ventral part of paratype male (D).

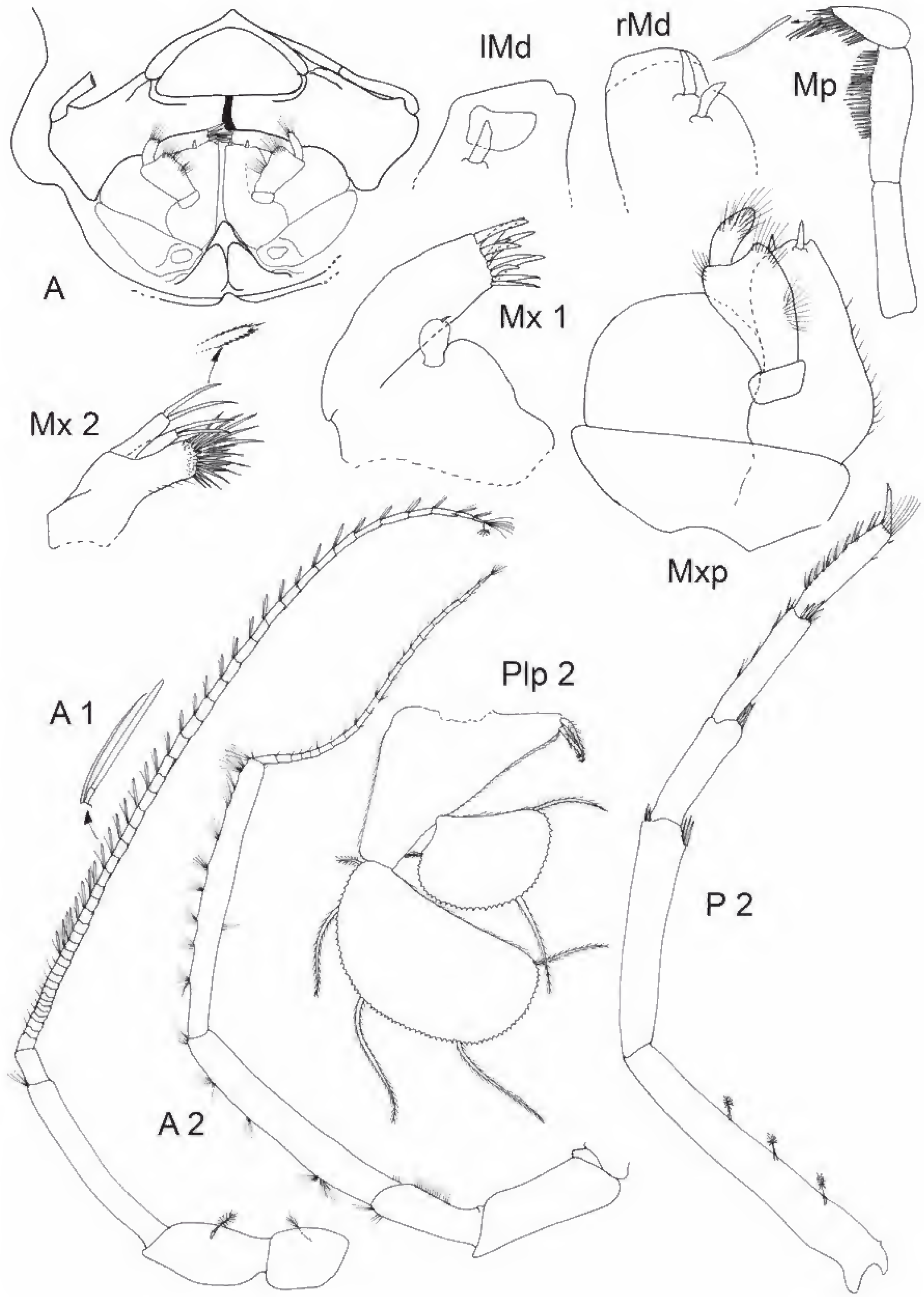

Figure 2 *Acutiserolis poorei* sp. nov., paratype female, head ventrally (A); paratype male, incisor of left and right mandible and mandibular palp, maxillula and maxilla; paratype female, antennula, antenna, pereopod 2 and pleopod 2.

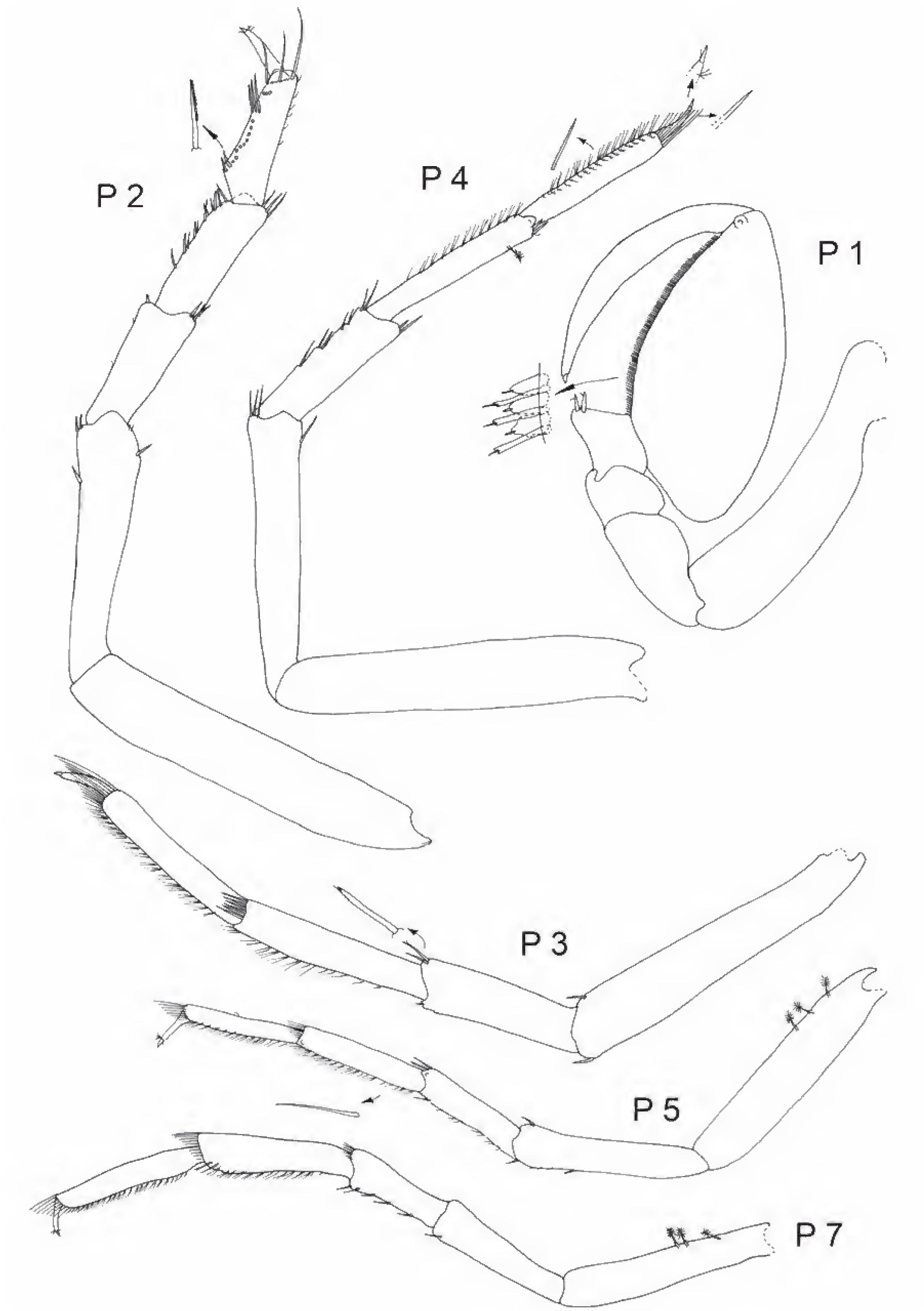

Figure 3 *Acutiserolis poorei* sp. nov., paratype male, pereopods 1–5, pereopod 7.

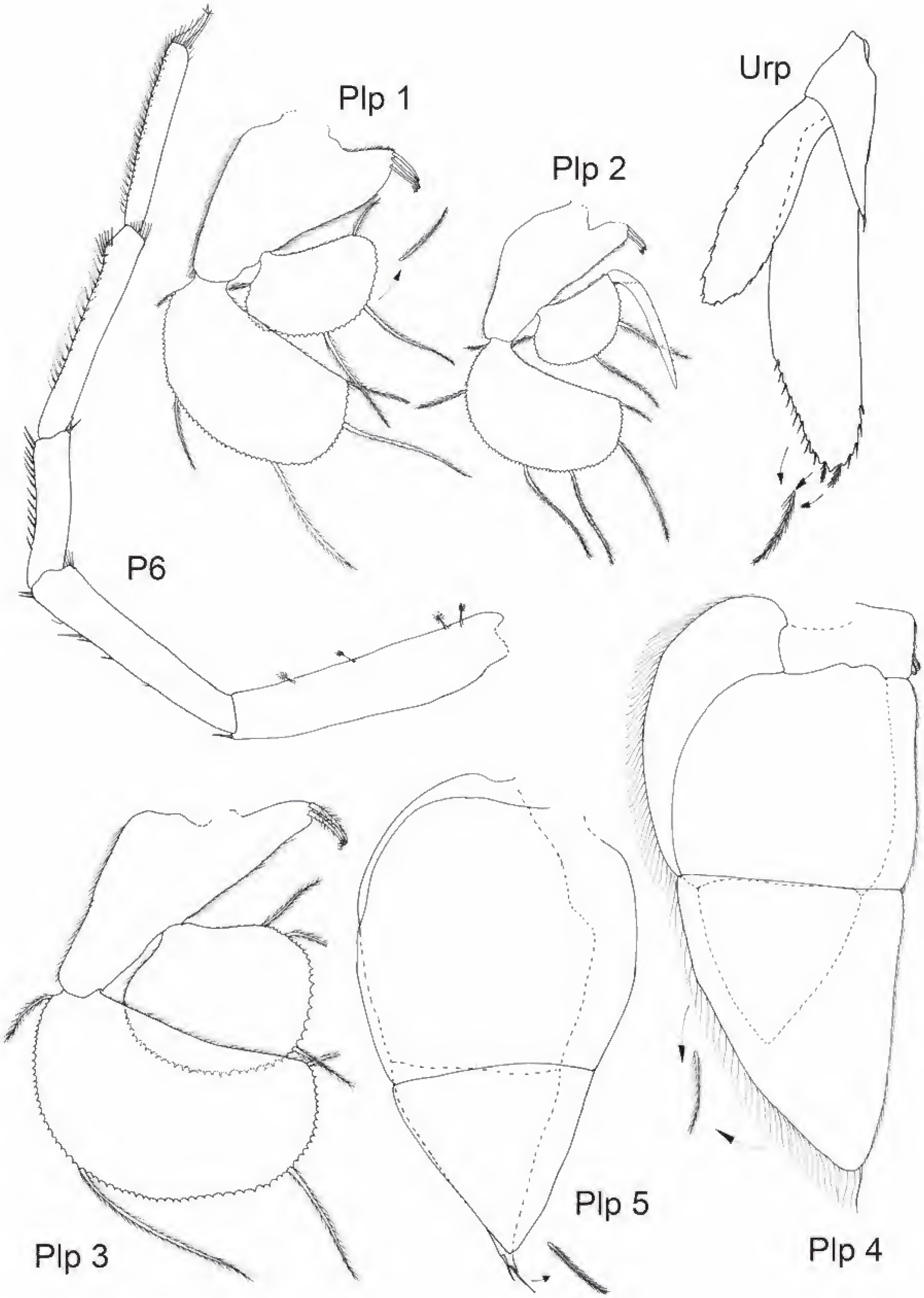

Figure 4 *Acutiserolis poorei* sp. nov., paratype male, pereopod 6, pleopods 1–5, uropod.

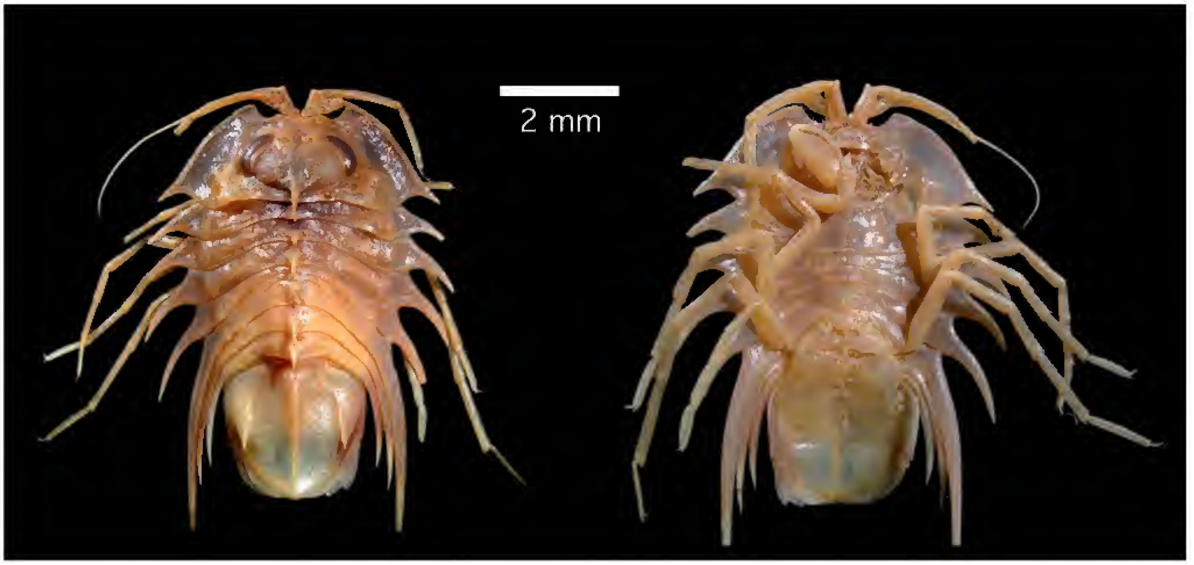

Figure 5. Photograph of *Acutiserolis spinosa* (Kussakin, 1967) (Zoological Museum of St. Petersburg) # 46416, holotype male of 32 mm length.

ones. Propodus only 1.1 broadened in the lower part, about as broad as a third of the length of the propodus, distally narrower. Propodus with three rows of long simple setae in distal third of the article besides distally setulated proximal ones. Dactylus less than half as long as propodus, with three dorsal setules, a short and small claw as well as a short ventral setule.

P3–7 of paratype male (figs. 3, 4) similar, P7 shortest. Long basis with 0–3 feather-like setae. Ischium 0.6–0.8 as long as basis with only very few short simple setae, especially distally, distodorsally a simple seta. Ventrally few setae present on ischium and some more on merus, most on carpus and propodus. Distodorsally of merus, carpus, and propodus a transverse row of long simple setae, most on carpus and propodus. Distodorsal region of propodus similar to that of carpus, but with longer and more simple setae. Dactylus very small and slender, only slightly longer than the distal setae of the propodus, with a very short apical claw and 1–3 short setules.

Plp1 of paratype male (fig. 4) sympodite bearing three proximomedially setulated setae, distally of these setae a setulated tuft (similar to a brush). Endopodite smaller than exopodite.

Plp2 of paratype male (fig. 4) with sympodite similar to that of Plp1, slightly smaller and only with two proximomedial setae. *Appendix masculina* about twice as long as endopodite, with short and blunt medial spine-like structures.

Plp3 of paratype male (fig. 4) similar to Plp1, bearing two proximomedially setulated setae. Endopodite smaller and more rounded than exopodite.

Exopodite of Plp4 of paratype male (fig. 4) medially with transverse fusion line, with a lateral row of short marginal plumose setae. Endopodite smaller without setae; sympodite very short, quadrangular, few medial setae.

Plp5 of paratype male (fig. 4) with short sympodite (damaged during dissection, not illustrated). Exopodite with 2 short distal plumose setae, endopodite smooth, as long as exopodite, both rami with transverse fusion line.

Urp of paratype male (fig. 4) with elongate trapezoidal sympodite, bearing a mediodistal simple seta. Exopodite 0.6 length of endopodite, both rami with short distal and mediolateral marginal, plumose setae, more on endopodite.

Remarks. *Acutiserolis poorei* sp. nov. can easily be distinguished from other species of the genus by the long mediocaudal acuminating spine on head reaching mid of third pereonite in dorsal view. The dorsal side of body bears scattered tubercles on all pereonites, pleonites and pleotelson, but much less than in *A. luethjei* (Wägele, 1986). Pereonites 6 and 7 not fused mediodorsally in *A. poorei* which is most similar to the type species *Acutiserolis spinosa* (Kussakin 1967) sampled at Ob-station, Scott Island, Pacific Ocean (67°21'S; 179° 53'E) between 500–900 m depth. Three specimens were collected in the Bellingshausen Sea and another four from the slope of Pine Island Bay, Amundsen Sea. The new species can be distinguished from *A. spinosa* in having less acute, shorter and less curved coxal plates, scattered tubercles on the dorsal surface (only illustrated on pleotelson) which are lacking in *A. spinosa* being characterised by a smooth dorsal surface. Moreover, *A. poorei* has a mediocaudal spine of the head which reaches to mid of third pereonites and not of second pereonite as in *A. spinosa*. Like in *A. spinosa*, no suture divided the coxal plates of the fifths coxa from the body in *A. poorei* which is visible at pereomers 2 to 4, however, the male *appendix*

masculina of *A. poorei* is shorter than that of *A. spinosa* (however, this could be due to the fact that we might have sampled only a sub-adult male). The comparison of the type of *A. spinosa* revealed some slight differences to the photographs presented by Poore and Storey (2009) (figure 5) with regard to the length of the pereonites and the strength of the dorsal spines. In fact the types have been sampled at 67°S, whereas the material Poore & Storey (2009) use for their description is from 65°S. *Acutiserolis gerlachei* (Monod, 1925) has an acuminating pleotelson with a frontomedial elevation which is lacking in *A. poorei*. *A. johnstoni* (Hale, 1952), has broader and stronger coxal plates with a much narrower gap between lateral epimers and the head is caudally diagonally acuminating and extending into a very long and acute spine, in *A. poorei* the lateral margin of the head is more rounded.

Held (2003) documented that *Ceratoserolis trilobitoides* (Eights, 1833) consists of several cryptic species and Bruce (2009) showed that *Caecoserolis novaecaledoniae* (Poore & Brandt, 1997) was a species complex of five species several of which were sympatrically occurring. Future genetic analyses might reveal further surprises with regard to cryptic species also within the genus *Acutiserolis*.

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Plesiomenaeus poorei gen. nov., sp nov., (Crustacea: Decapoda: Pontoniinae) from Zanzibar

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Abstract

Bruce, A.J. 2009. *Plesiomenaeus poorei* gen. nov., sp nov., (Crustacea: Decapoda: Pontoniinae) from Zanzibar. *Memoirs of Museum Victoria* 66: 25–34.

A new genus, *Plesiomenaeus*, is designated for a new species of sponge associated pontoniine shrimp, *P. poorei*, from Zanzibar, which is described and illustrated. The new genus resembles *Periclimenaeus* Borradaile, from which it is distinguished particularly by the lack of a molar process and fossa on the fingers of the major second pereiopod. *Plesiomenaeus poorei* also closely resembles *Periclimenaeus bouvieri* (Nobili) and the relationship is discussed.

Keywords *Plesiomenaeus poorei* gen. nov., sp. nov., Crustacea: Decapoda: Pontoniinae, sponge associate, Zanzibar.

Introduction

Recent re-examination of some specimens from Zanzibar, provisionally identified as *Periclimenaeus*? sp. nov., indicated that they were not members of the genus *Periclimenaeus* Borradaile, 1915, *sensu stricto*, as the fingers of the major second pereiopod lacked the characteristic features of the second pereiopod of that genus, in which the fingers are provided with a dactylar molar process and opposing fossa on the fixed finger. The specimens could not be referred to any other pontoniine genus and a new genus is now designated for their reception. The new species resembles very closely the species *Typton bouvieri* described from Djibouti by Nobili (1904, 1906) and also reported from Suez by Balss (1927). There have been no subsequent reports of Nobili's species, which was transferred to the genus *Periclimenaeus* Borradaile, 1915, by Holthuis (1952). Holthuis, when examining the five syntypes, noted that the major second pereiopod dactyl has the cutting edge provided with "a strong hammer shaped tooth fitting into a cavity on the fixed finger", clearly indicating that *T. bouvieri* is correctly placed in *Periclimenaeus* Borradaile.

Abbreviations used: CL, postorbital carapace length; NMV, National Museum of Victoria, Melbourne: MNHN, Muséum National d'Histoire Naturelle, Paris. RMNH, Nationaal Natuurhistorisch Museum–Naturalis, Leiden; OUMNH, Oxford University Museum of Natural History, Oxford; QM, Queensland Museum, Brisbane.

Systematic Account

FAMILY PALAEMONIDAE Rafinesque, 1815

Subfamily Pontoniinae Kingsley, 1878

Plesiomenaeus gen. nov.

Diagnosis Rostrum greatly reduced, compressed, uni-dentate, carapace without supraorbital, epigastric, hepatic or antennal spines, inferior orbital angle acute, first abdominal tergite without anteromedian lobe, pleura rounded, telson with two pairs of small dorsal spines, three pairs of posterior marginal spines, scaphocerite reduced, labrum normal, mandible without palp, maxillipeds with flagella slender, with four long, plumose terminal setae, maxilla with basal endite simple, third maxilliped with ischiomerus and basis fused, coxa without arthrobranch, fourth thoracic sternite without median process, first pereiopod chela with fingers subspatulate, cutting edges entire, dactyl with tridentate tip, medial and lateral teeth denticulate, fixed finger distally bidentate, second pereiopods well developed, unequal, similar, major dactyl fingers simple, without molar process and fossa, minor fingers non-shearing, ambulatory pereiopods robust, third propod most slender, fifth propod stoutest, dactyls simply biunguiculate, uropodal propod unarmed, exopod of uropod with distolateral tooth and spine.

Type species. *Plesiomenaeus poorei* sp. nov., by present selection and monotypy.

Etymology. From *plesios* (Greek) near, and part of the name *Periclimenaeus,* first used by Borradaile (1915), as the shrimp was initially identified as a strange *Periclimenaeus*. Gender masculine.

Systematic position. The genus *Plesiomenaeus* most closely resembles the genus *Periclimenaeus* Borradaile1915, type species *Periclimenaeus robustus* Borradaile, 1915 (re-described by Bruce, 2005). In this species a marked thickening

of the posterior three fifths of the second pereiopod dactylar cutting edge is distinctly demarcated from the swollen base of the dactyl (Bruce, 2005, fig. 2C). This thickened portion is less developed than in several other species of the genus where it forms the typical posteriorly and anteriorly demarcated molar tooth, with a large well delineated opposing socket on the fixed finger. In *P. robustus*, and other species of *Periclimenaeus*, the occlusal surface of this thickened portion is distinctly flattened. In *Periclimenaeus*, and many other pontoniine genera, the proximal occlusal end of the dactyl is normally swollen and quite distinct from the molar process which is developed on the intermediate portion of the cutting edge (see fig, 4J, *Periclimeaeus gorgonidarum* (Balss), Wilson Island, Queensland, 6.0 m, coll. N.L. Bruce, 28 August 1980, AJB 3106, QM W28914). In contrast, in *Plesiomenaeus* there is no trace of a molar process in this position. The proximal dactyl is swollen and articulates in a deep longitudinal depression in the proximal fixed finger but this lacks a defined anterior margin and does not form a socket. In *Plesiomenaeus* the second pereiopod chelae are similar but differing in size, in contrast in *Periclimenaeus* they are of different morphology. *Plesiomenaeus* also lacks the anteromedian lobe on the dorsal margin of the first abdominal tergite conspicuous in *P. robustus*.

Plesiomenaeus poorei sp. nov.

Figures 1–7

Material examined. 1 ovig. ♀, holotype, Chukwani, Unguja, Zanzibar, 6° 13' 60"S 30° 13' 00"E, 0.1m at low water spring tide, 4 December 1960, coll. A.J. Bruce, #271, NMV J59993. 1 ♂, allotype, *idem*, NMV J59994. Ovig. ♀, dissected, *idem*, NMV J59995. 1 ♂, 1 ovig. ♀, paratypes, *idem*, MNHN-Na17209. 1 ♂, 1 ovig. ♀, paratypes, *idem*, QM W28956. 1 ♂, 1 ovig. ♀, paratypes, *idem*, OUMNH. ZC.2009-12-001. 1 ♂, 1 ovig. ♀, paratypes, *idem*, RMNH D 53113.

Diagnosis. With the characters of the genus. Very short rostrum generally with single dorsal tooth only, proximal segment of antennular peduncle distolaterally rounded, without acute tooth, ventral border of second pereiopod merus non-tuberculate.

Description. A stoutly built shrimp of subcylindrical body form (fig. 1).

Rostrum (fig. 6A) very short, about 0.06 of CL, compressed, triangular, acute, with singe acute dorsal tooth, carapace (fig. 2A) smooth, without supraorbital, epigastric, hepatic or antennal spines, inferior orbital angle (fig. 2B) acute, pterygostomial angle strongly produced, rounded.

Abdomen smooth, first segment without anterior median dorsal lobe, pleura rounded, sixth segment (fig. 2C) depressed, about 0.24 of CL, with small subacute posterolateral tooth and much larger, acute posteroventral tooth; telson (fig. 2D) about 0.35 of CL, 2.15 times longer than anterior width, lateral margins slightly convex, tapering posteriorly, posterior margin rounded (figs 2E, 6J) two pairs of small submarginal dorsal spines, about 0.08 of telson length, anterior pair at 0.65 of telson length, posterior pair at about 0.96 (see Remarks), with three pairs of marginal spines, lateral spines similar to dorsal spines, intermediate spines about 0.1 of telson length, submedian spines more slender, finely setulose, about 0.8 of intermediate spine length.

Antennule (fig. 2F) with proximal segment of peduncle (fig. 2G) about twice as long as proximal width, lateral margin straight, non-setose, without ventromedial tooth, lateral margin angular, distolateral angle rounded (fig. 6B) with 1–2 short plumose setae, sometimes acute, stylocerite acute, projecting laterally, reaching to about half segment length, statocyst poorly developed, without statolith, intermediate and distal segments short and broad, combined length about 0.4 of proximal segment length, upper flagellum short, biramous, with proximal 8 segments fused, short free ramus with single long segment, with 2 groups of aesthetascs, longer free ramus with 5 slender segments, lower flagellum short, filiform with 10 segments.

Antenna (fig. 2H) with carpocerite subcylindrical, about 3.0 times longer than wide, basicerite robust, without lateral tooth, with large rounded protuberant antennal gland process medially; scaphocerite (fig. 2I) small, subequal to carpocerite length, about 2.7 times longer than wide, distally rounded, lateral margin straight with small acute distal tooth, at about 0.9 of scaphocerite length, well short of margin of lamella, distal and medial margins with numerous short plumose setae.

Epistome unarmed, without special features.

Eye, (fig. 2J), with hemispherical cornea, well pigmented, diameter about 0.13 of CL, without accessory ocellus, stalk globular, about 1.1 times longer than wide.

Mandible (fig. 3A) small, without palp, molar process (fig. 6D) subcylindrical, tapering distally, distally obliquely truncate with two small teeth and numerous rows of short spiniform setae, incisor process small (fig. 6E) narrow, distally rounded with three small acute teeth laterally, two smaller teeth medially.

Maxillula (fig. 3B) with bilobed palp (fig. 6F), upper lobe larger than lower, lower tapering with distal tubercle with short slender terminal seta, upper lacinia (fig. 6G) short and broad, upper margin emarginate, distal margin broadly truncate with about 16 short simple spines and scattered setae, lower lacinia tapering distally with six terminal spines and numerous spiniform setae.

Maxilla (fig. 3C) with simple tapering palp, with few short plumose setae proximo-laterally, basal endite simple, short and broad, with 10 slender sparsely setulose terminal setae, coxal endite obsolete, medial margin broadly rounded, non-setose, scaphognathite well developed, about 2.6 times longer than wide, anterior lobe as long as wide, medial margin concave, posterior lobe about 0.8 of anterior lobe length.

First maxilliped (fig. 3D) with palp (fig. 6H) about 2.5 times longer than wide, distally rounded, with two preterminal feebly setulose setae disto-medially, basal and coxal endites fused, distally rounded medial margin straight, with numerous slender sparsely setulose marginal setae, exopod with well developed caridean lobe, flagellum slender with four long plumose terminal setae, epipod well developed, bilobed.

Second maxilliped (fig. 3E) with endopod normally developed, dactylar segment about 3.4 times longer than broad, medial margin with numerous long slender coarsely setulose or finely denticulate spines, propodal segment distomedially

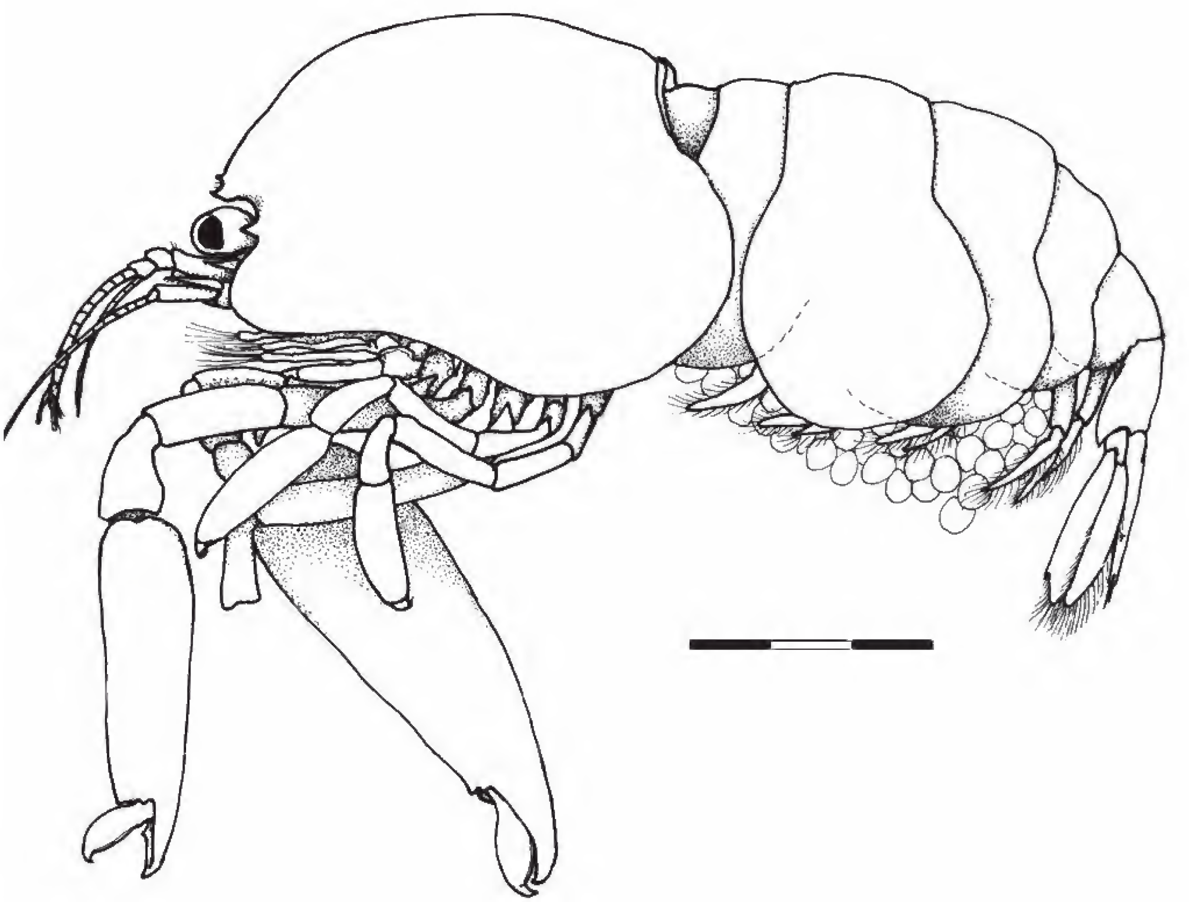

Figure 1. *Plesiomenaeus poorei* gen. nov., sp., ovig. ♀. Holotype, NMV J59993, Scale bar in millimetres.

produced, with numerous long slender sparsely setulose marginal spines, proximal endopod segments normal, basis with slender flagellum, coxa with small suboval epipod, without podobranch.

Third maxilliped (fig. 3F) with ischiomerus and basis fully fused, combined segment about 3.0 times longer than maximal width, tapering distally, medial margin straight with numerous long slender simple setae, carpus subcylindrical, half ischiomerus-basis length, 4.0 times longer than wide, with numerous spiniform setae medially, distal segment missing in dissected specimen, exopod with slender flagellum, slightly exceeding distal merus, with four major plumose terminal setae (broken off in dissected specimen), coxal with well developed low rounded lateral plate, without arthrobranch. Paragnaths (fig. 6C) deeply bilobed.

Thoracic sternites unarmed, narrowest at fourth and fifth segment levels and broadening anteriorly and posteriorly.

First pereiopod (fig. 4A) short, robust, chela (fig. 4B) with palm 1.5 times longer than deep, compressed, with numerous short simple cleaning setae proximo-ventrally, fingers subspatulate, with numerous groups of short simple setae, cutting edges entire, dactyl with tridentate tip (fig. 6I) medial and lateral teeth posteriorly tuberculate, fixed finger distally deeply bidentate (fig. 6I) simple; carpus 0.59 of chela length, 2.9 times longer than distal width, with transverse row of distal marginal cleaning setae with 3 long distoventral setae; merus 1.3 times longer than chela, 5.7 times longer than wide, uniform, slightly bowed; ischium 0.33 of chela length, 0.28 of meral length, basis subequal to ischial length; coxa robust, without ventral process, with dorsal flange.

Second pereiopods well developed, unequal, similar, fingers up-curved. Major chela (fig. 4C) length subequal to CL, palm smooth, oval in section, about 2.1 times longer than

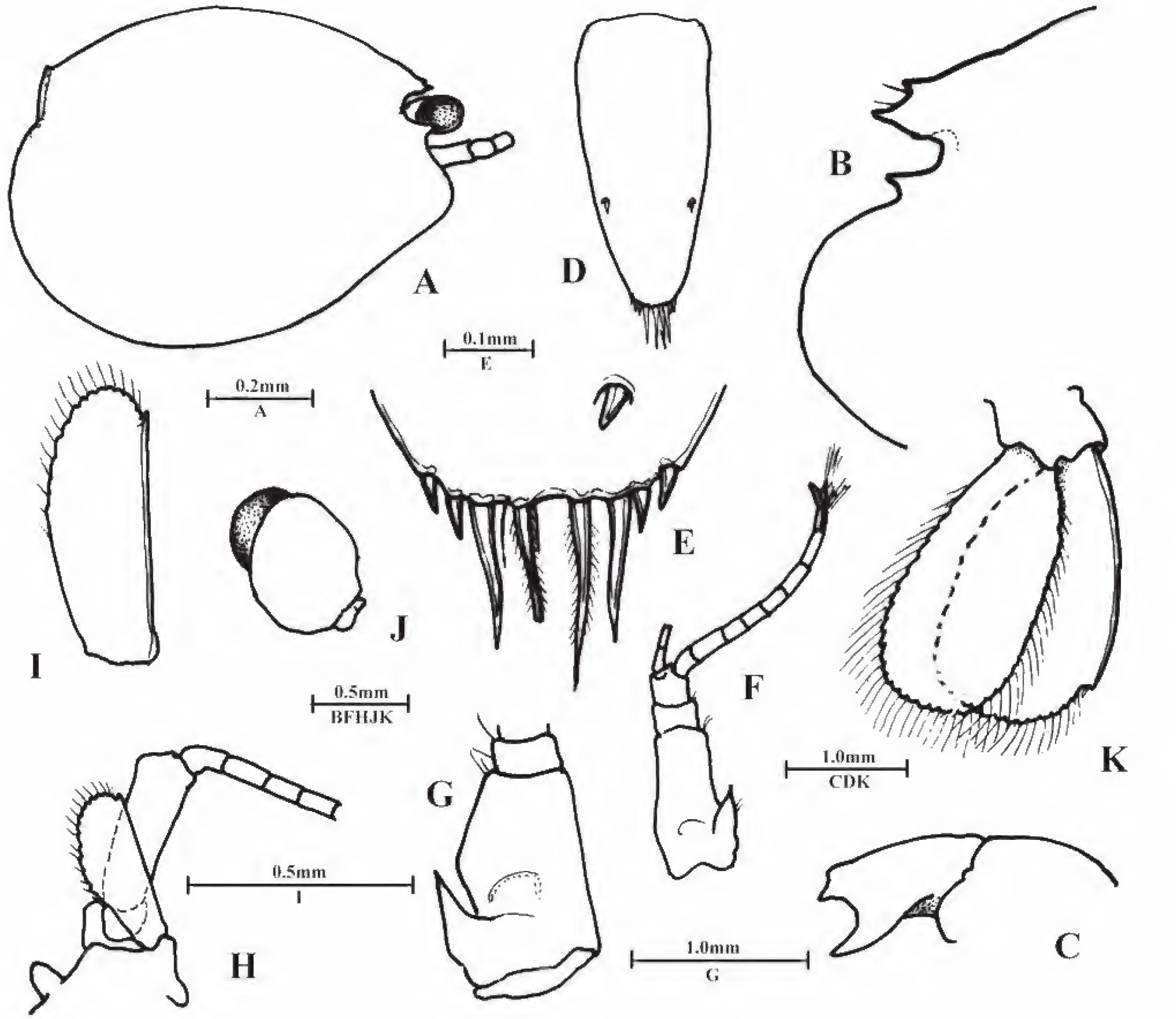

Figure 2. *Plesiomenaeus poorei* gen. nov., sp., ovig. ♀. NMV J59994. A, carapace and rostrum. B, anterior carapace and rostrum. C, sixth abdominal segment, lateral. D, telson. E, same, posterior spines, dorsal spine inset. F, antennule. G, same, proximal segment. H,. antenna. I, scaphocerite. J, eye. K, uropod.

deep, tapering distally, distal width about 0.6 of maximal width, non-setose; fingers (fig. 4CDE) 0.25 of palm length, dactyl about 3.0 times longer than proximal depth, dorsal margin convex, with strong acute tip, cutting edge without molar process, unarmed, feebly convex, entire, sharp, fixed finger about 1.8 times longer than proximal depth, ventral margin convex, with acute tip distally, occlusal edge longitudinally grooved throughout length with deep depression proximally, dorsal margin with bluntly triangular tooth proximally, with sharp entire cutting edge, ventral cutting edge similar, without proximal tooth, carpus robust, about 0.4 of palm length, distally expanded, 1.5 times longer than distal width, tapering strongly proximally, unarmed, merus about 0.5 of palm length, 3.0 times longer than wide, unarmed, ventrally non-tuberculate; ischium 0.8 of merus length, 0.4 of palm length, 2.4 times longer than distal width, tapering proximally, unarmed, basis and coxa robust, without special features. Minor second pereiopod chela (fig. 4G) similar to major chela, subequal to palm length of major chela, palm 3.5 times longer than depth, tapering slightly distally, fingers (fig.

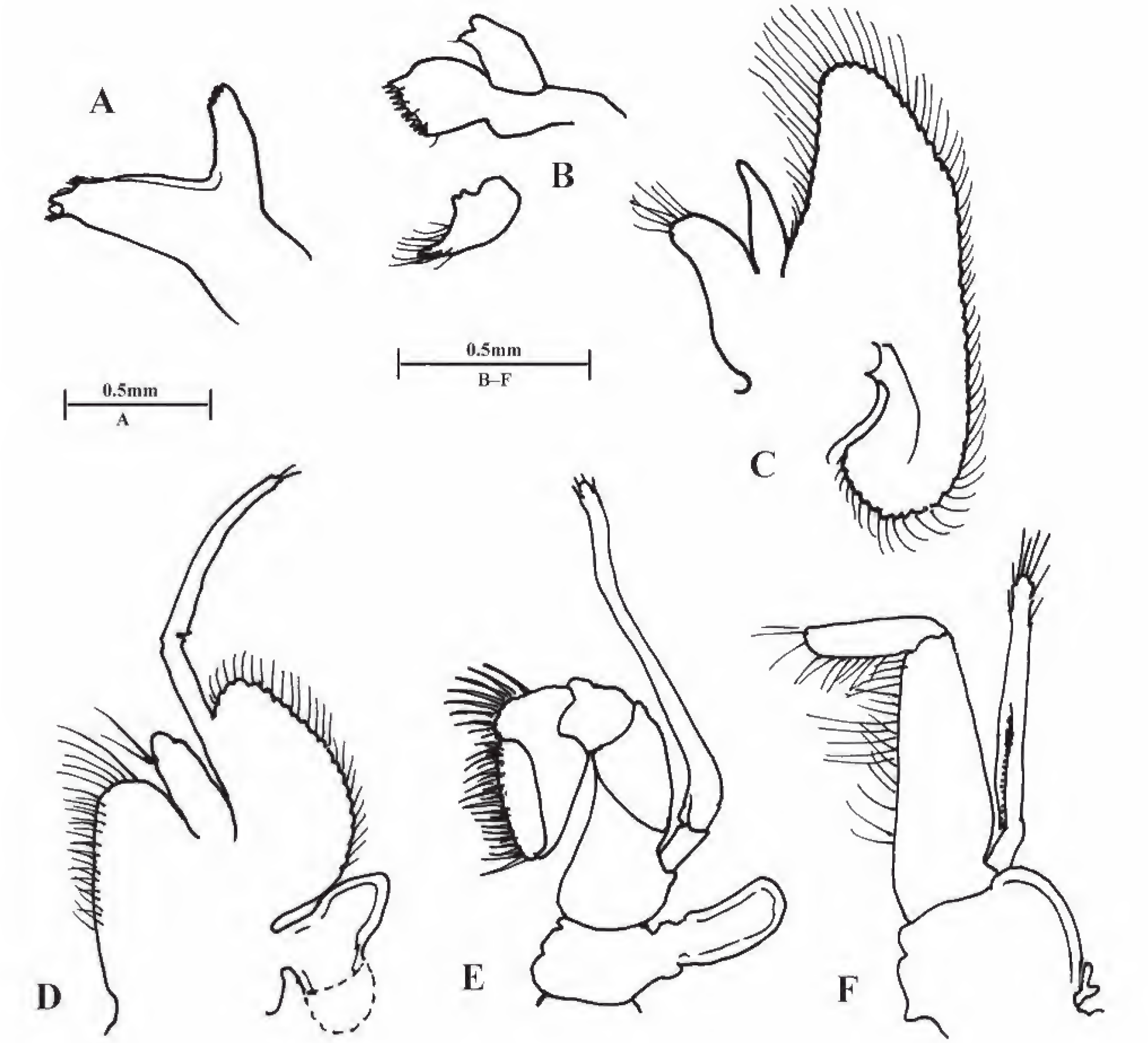

Figure 3. *Plesiomenaeus poorei* gen. nov., sp., ovig. ♀. NMV J59994. A, mandible. B, maxillula. C, maxilla. D, first maxilliped. E, second maxilliped. F, third maxilliped (terminal segment of endopod missing).

4H) 0.25 of palm length, similar to major chela, carpus 0.33 of palm length, 2.0 times longer than distal width; proximal segments as for major chela but smaller.

Third ambulatory pereiopod (fig. 4I) moderately slender, reaching beyond carpocerite by propod and dactyl; dactyl short, stout, compressed, about 0.12 of propod length, unguis well developed, curved, 2.2 times longer than basal width, 0.33 of corpus length, unarmed, corpus 1.2 times longer than proximal depth, with dorsal margin strongly convex, ventral margin sinuous, distally concave, sharp, unarmed, with acute distal accessory tooth, about 0.5 of unguis length, with several simple ventral sensory setae; propod about 0.3 of CL, 5.5 times longer than proximal width, tapering distally, distal width 0.66 of proximal width, with three stout spines distally, medial, lateral and ventral, medial spine longest, 3.7 times longer than basal width, projecting beyond dorsal margin of flexed dactyl, ventral spine shortest, 0.8 of medial spine length, ventral margin of propod otherwise without spines; carpus 0.8 of propod length, 4.0 times longer than distal width, slightly tapering proximally, unarmed; merus subequal to propod length, 3.4 times longer

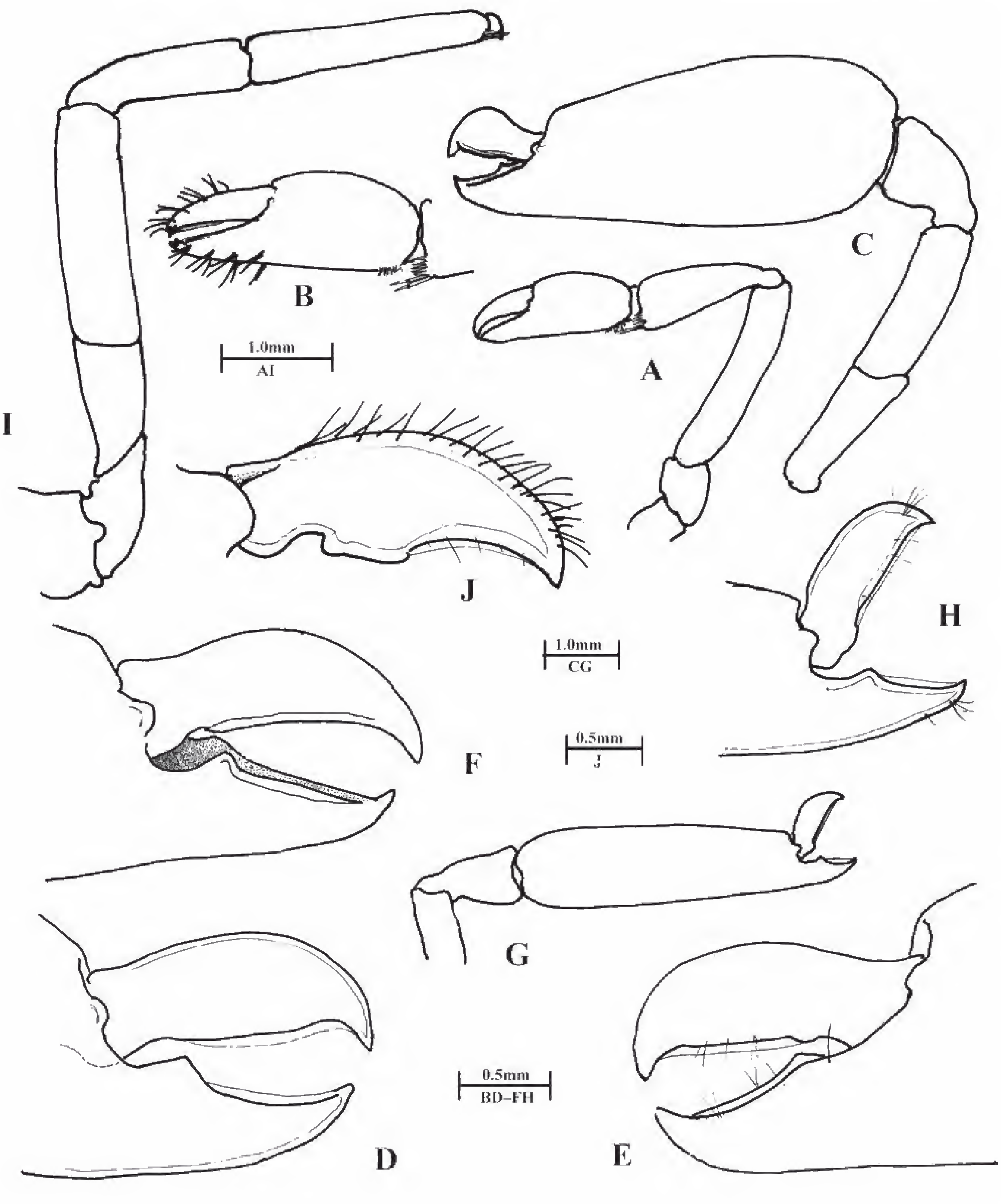

Figure 4. *Plesiomenaeus poorei* gen. nov., sp., ovig. ♀ holotype, NMV J59993. A, first pereiopod. B, same, chela. C, major second pereiopod, D, same, fingers, lateral. E, same, medial. F, same, oblique. G, minor second pereiopod, chela and carpus. H, same, fingers. I, third pereiopod. J, *Periclimenaeus gorgonidarum* (Balss), QM W28914, major second pereiopod dactyl.

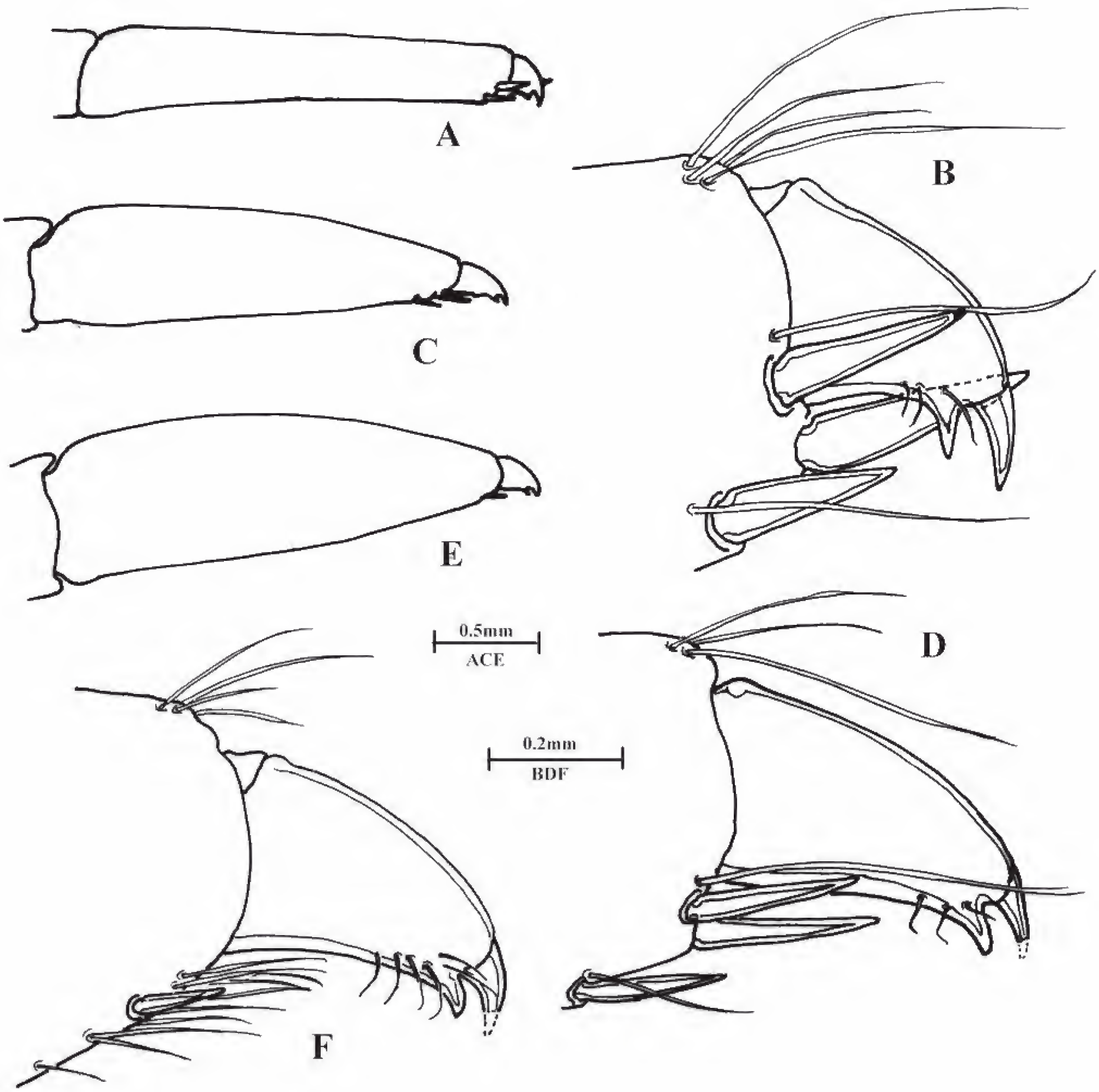

Figure 5. *Plesiomenaeus poorei* gen. nov., sp., ovig. ♀. NMV J59994. A, third pereiopod, propod and dactyl. B, same, distal propod and dactyl,. C, fourth pereiopod, propod and dactyl. D, same, distal propod and dactyl. E, fifth pereiopod, propod and dactyl. F, same, distal propod and dactyl.

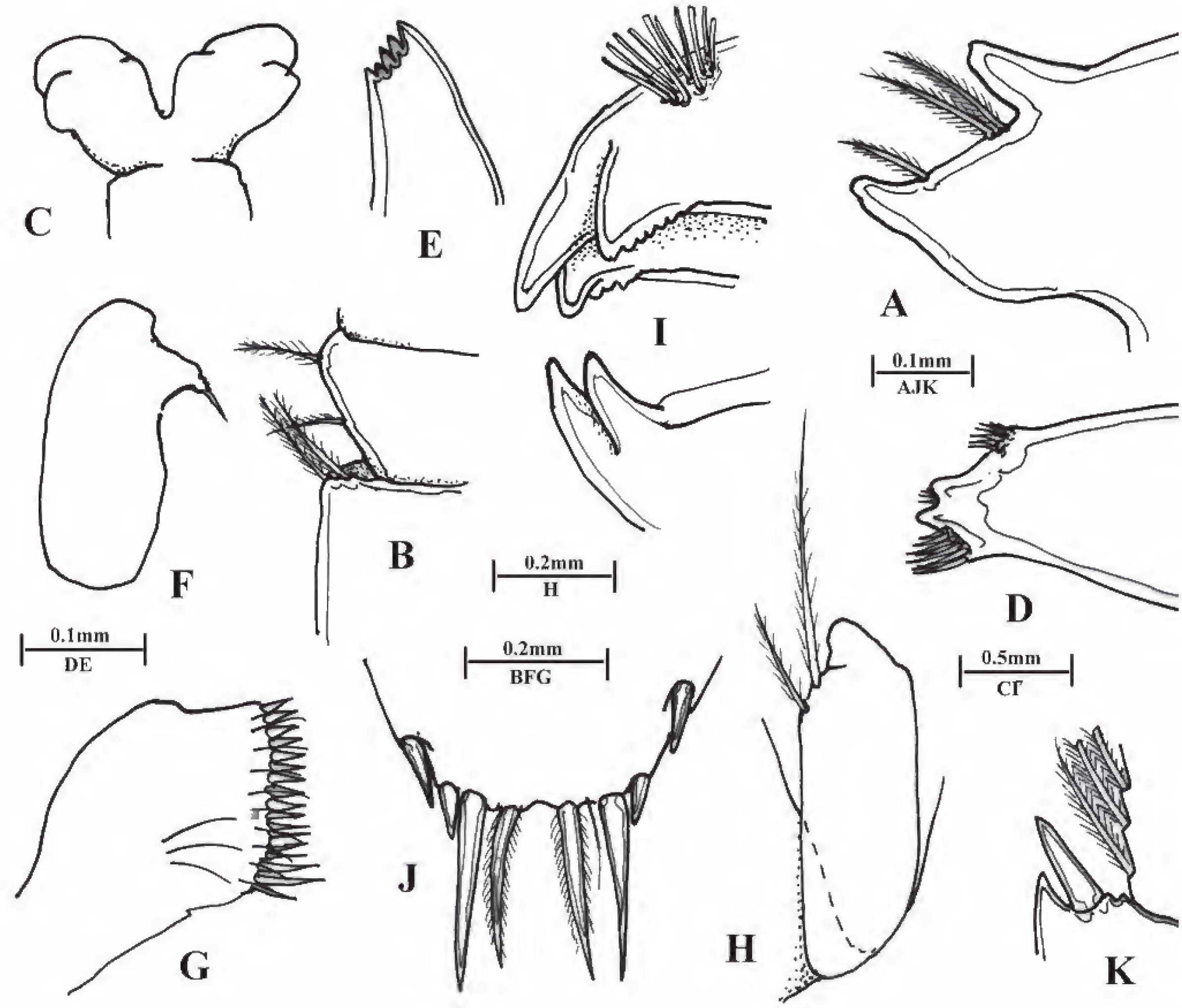

Figure 6. *Plesiomenaeus poorei* gen. nov., sp., ovig. ♀. NMV J59994. **A,** rostrum. B, antenna, distolateral angle of proximal segment. C, paragnath, D, mandible, molar process. E, same, incisor process. F, maxillula, palp. G, same upper lacinia. H, first maxilliped, palp. I, first pereiopod chela, finger tips. J, telson, posterior margin. K, uropod, distolateral exopod.

than wide, unarmed; ischium 0.55 of propod length, twice as long as distal width, tapering proximally, unarmed; basis and coxa without special features. Fourth pereiopod similar, propod subequal in length but more swollen, 3.6 times longer than proximal depth, maximal width 3.0 times distal width, with shorter, more slender medial, lateral and ventral spines, dactyl with corpus 1.6 times longer than proximal depth, unguis 0.2 of corpus length, accessory tooth smaller. Fifth pereiopod similar, propod subequal in length but propod more swollen than fourth, 3.2 times longer than proximal depth, maximal width 2.8 times distal width, with single small ventral spine and numerous distoventral setae, dactyl about 0.12 of propod length, with corpus 1.5 times longer than proximal depth, unguis 0.2 of corpus length, accessory tooth smaller.

First pleopod (fig. 7C) male paratype (CL 3.4mm) with protopod about 2.5 times longer than broad, exopod subequal to protopod length, 5.0 times longer than wide with numerous plumose marginal setae, endopod, 0.7 of exopod length, 5.0 times longer than proximal width, tapering distally, without medial accessory lobe, with numerous, about 20, simple spiniform setae scattered along medial border. Second pleopod (fig. 7D) with protopod 2.0 times longer than wide, greatest

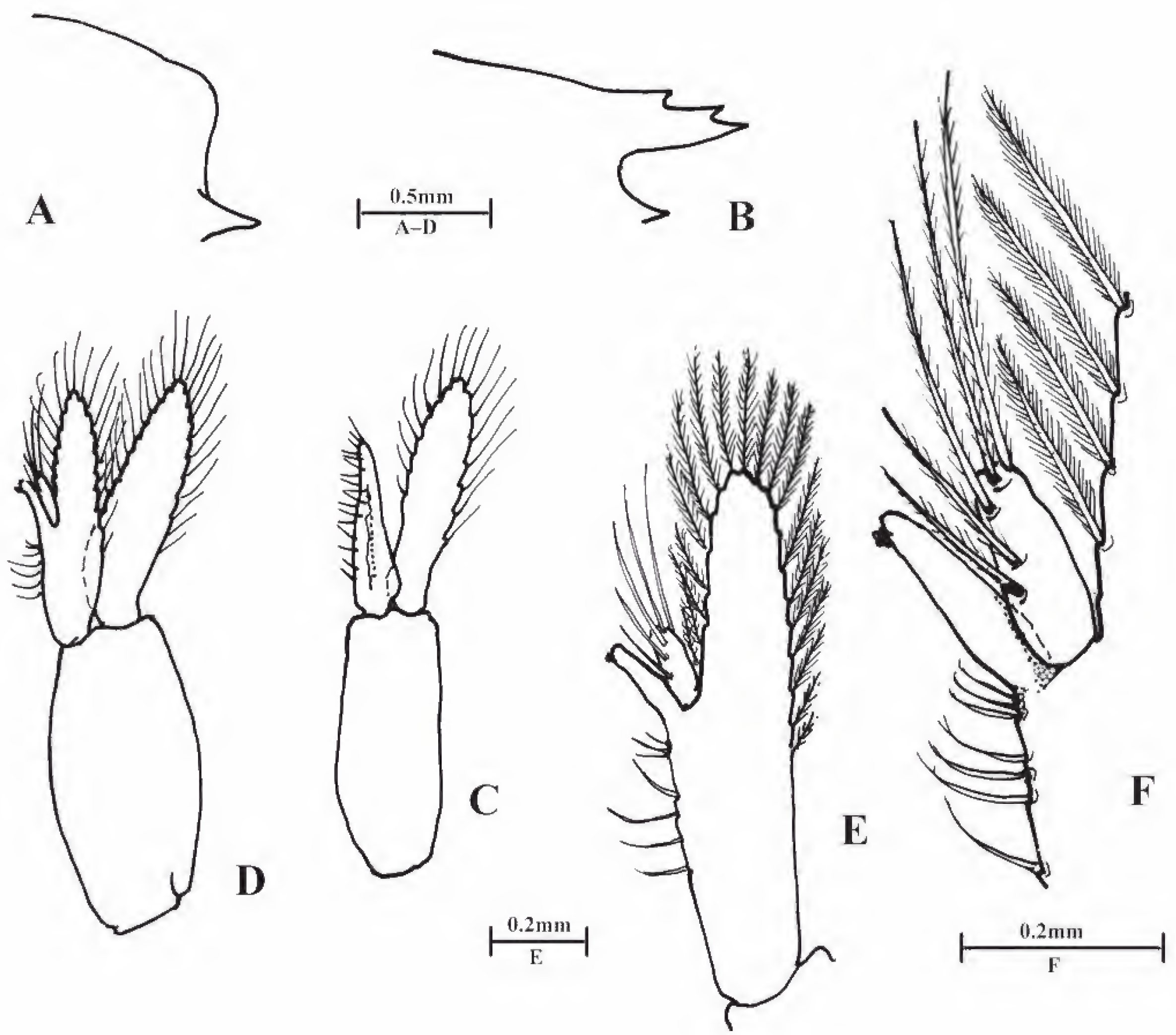

Figure 7. *Plesiomenaeus poorei* gen. nov., sp. nov, **A,** abnormal rostrum, ovig. female paratype. B, rostrum, male paratype, CL 3.4. C, first pleopod. D, same, endopod. E, second pleopod. F, same, endopod. G, same, appendices, masculina and interna.

width centrally, 1.2 times longer than first pleopod protopod, exopod similar to first pleopod, endopod (fig. 7E) subequal exopod length, 4.4 times longer than central width, with numerous plumose marginal setae distally, appendices (fig. 7F) at 0.55 of medial margin length, appendix masculina subcylindrical, 2.5 times longer than wide, about 0.16 of endopod length, with 5 setulose setae of increasing length distally along medial margin, terminal seta longest, about twice corpus length' appendix interna slightly longer than appendix masculina, with few terminal cincinnuli.

Uropod (fig. 2K) with protopod unarmed; exopod broad, about 1.6 times longer than broad, lateral margin feebly convex, non-setose with small acute distal tooth (fig. 6K) with small spine medially (see *Remarks*); endopod 0.95 of exopod length, 2.0 times longer than wide.

Measurements (mms). Holotype, ovigerous female, postorbital carapace length, 6.0; carapace and rostrum, 6.4; total body length (approx.) 17.0; second pereiopod, major chela, 6.0; minor chela, 5.0; length of ovum, 0.55.

Etymology. Named for Dr Gary C.B. Poore, Principal Curator (Marine Biology), Museum of Victoria, in recognition of his major contributions to Australian and wider carcinology over many years.

Host. Unidentified sponge encrusting round the base of a coral colony.

Colouration. No data.

Remarks. The telson of the holotype is slightly abnormal in that the posterior pair of dorsal spines are placed on the posterior margin of the telson which thus presents the appearance of having four pairs of posterior marginal spines, with only a single pair of dorsal spines. One female (fig. 7A) was without a rostrum, the absence appearing congenital rather than traumatic. Two of the male specimens (fig. 7B) had two rostral teeth. Some specimens had a small acute distolateral tooth on the proximal segment of the antennular peduncle, usually asymmetrically.

The presence of slender propods on the third pereiopod and stouter propods on the posterior limbs is unusual in pontoniine shrimps. In some species of the closely related genus *Periclimenaeus* the propods are not greatly different but in others, such as *P. crassipes* Calman and *P. trispinosus* Bruce, the third pereiopod propods are particularly short and stout and the posterior propods longer and more slender, in contrast to their development in *P. poorei* sp. nov.

Despite intensive collecting over the coral reefs of Zanzibar, and similar reefs in Tanganyika and Kenya, over several years, resulting in numerous other sponge associated shrimps, no further specimens of this species were ever collected.

The resemblance of *P. poorei* sp. nov. to *Periclimenaeus bouvieri* (Nobili) is remarkable. Holthuis's statement that "a strong hammer shaped tooth fitting into a cavity on the fixed finger", leaves little doubt concerning these features and the placement of Nobili's species in *Periclimenaeus*. Re-examination of the type material of Nobili's species may shed further light on the detailed morphology of the fingers of the major second pereiopod and hence its exact systematic position. *Plesiomenaeus poorei* sp. nov. is readily distinguished from *Periclimenaeus bouvieri* by having only a single dorsal rostral tooth in females and a non-tuberculate second pereiopod merus as opposed to two dorsal rostral teeth and a ventrally tuberculate merus in addition to the absence of a molar process and fossa on the major second pereiopod fingers. The type material of *Typton bouvieri* is held in the collections of the Museo Regionale di Scienze Naturali, Torino.

Acknowledgements

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A new genus and new species of Sphaeromatidae (Crustacea: Isopoda) from the Great Barrier Reef, Australia

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Abstract Bruce, N. L. 2009. A new genus and new species of Sphaeromatidae (Crustacea: Isopoda) from the Great Barrier Reef, Australia. *Memoirs of Museum Victoria* 66: 35–42.

Pooredoce garyi gen. nov., sp. nov., is described from Lizard Island, northern Great Barrier Reef, Australia. The genus is related to the group of sphaeromatid genera characterised by having long 'finger-like' extensions to the articles of the maxilliped palp, stout robust setae on the inferior margins of pereopods 1–3 and the uropodal endopod round in section, with the exopod about half as long as the endopod; similar genera are *Cymodoce* Leach, 1814 (Indo-Pacific species), *Koremasphaera* Bruce, 2003 and *Oxinasphaera* Bruce, 1997. *Pooredoce* gen. nov. is characterized by the adult male having a dorsally recessed dorsum to the pleotelson, the posterior margin of which has three enclosed foramens, two visible dorsally, the third visible only from the interior of the posterior margin, the two foramens are formed by the pleotelson posterolateral and median margin lobes coming into contact posteriorly; and the posterior margin of the pleon forms an irregular posteriorly directed ridge. *Pooredoce garyi* was collected from the reef crest and is known from the type locality, Lizard Island and at Hicks Reef.

Keywords Crustacea, Isopoda, Sphaeromatidae, Great Barrier Reef, coral reef, Queensland, Australia, southwestern Pacific, taxonomy

Introduction

The Sphaeromatidae of the Great Barrier Reef can be considered as comparatively well known, notably following the work of British authors Keith Harrison and David Holdich (e.g. Harrison and Holdich 1982, 1984; also Bruce 1997; earlier references therein). Poore (2002; 2005) lists 203 species of Sphaeromatidae from Australia, 60 of which are known from Queensland. In comparison eastern Africa (southern Somalia to Mozambique and Madagascar), a similar stretch of tropical continental coast, has 34 recorded species of Sphaeromatidae (Benvenuti and Messana 2000; Kensley 2001; Schotte and Kensley 2005), but the intensity of sampling would probably have been far lower than in Queensland. The Great Barrier Reef, including the adjacent Coral Sea reefs, has 23 species of Sphaeromatidae, recorded principally from Heron Island and Lizard Island, the sites of two major research stations. Despite the high number of species, documentation of this family is far from complete for the Great Barrier Reef and tropical Australia, Poore et al. (2002) commenting that the documented diversity for the family in Australia is still at about 50% of the expected total.

This contribution describes a new genus and new species from the northern Great Barrier Reef, Queensland, named with pleasure for Gary Poore, colleague and friend, in recognition of his great contribution to knowledge of Australian isopod and decapod crustaceans.

Methods and abbreviations

Terminology, measurements and descriptions follow Bruce (e.g. 1997, 2003). The generic description was produced using a DELTA (Dallwitz et al. 1997) generic data set that is under development. Setal terminology follows Watling (1989).

Abbreviations

RS—robust seta/setae; PMS—plumose marginal seta/e; MTQ—Museum of Tropical Queensland, Queensland Museum, Townsville.

Taxonomy

Family Sphaeromatidae Latreille, 1825

Pooredoce gen. nov.

Type species. Pooredoce garyi, sp. nov., here designated and by monotypy.

Diagnosis. Adult male. *Pereonite 7* narrower than pereonite 6, not extending to lateral body margin. Pleon dorsal surface without process; posterior margin with plate-like extension.

Pleotelson dorsally flat, posterior margin with two small submedian foramens, with hardened boss anterior to median notch, with ventral thickened rim; lateral margins forming dorsally directed ridge. *Maxilliped* palp articles 2–4 medial margins extended, forming finger-like lobes. Uropod exopod reduced, mobile, round in section, inserted near midpoint of lateral margin of peduncle-endopod, distally with hard terminal spike; endopod round in section, distally with hard terminal spike.

Description of male. Body vaulted, dorsal surfaces granular, densely setose, unable to conglobate; strongly sexually dimorphic. *Head* with rostral point present, dorsally visible, separating antennular bases; without paired incisions in front of eyes, lateral margins not laterally extended to body outline (antennules more or less ventral). *Eyes* lateral, posteriorly lobed. *Pereonite 1* lateral margins not anteriorly produced, not laterally enclosing head, anteriorly without 'keys'; pereonites 2– or 5–7 with posterior margin raised, forming broad and low transverse ridge. *Sternite 1* without cuticular mesial extensions. *Pereonite 7* narrower than pereonite 6, coxal margin free. *Coxae* distally narrow, distally rounded, coxae without ventral 'lock and key' processes or ventral groove, those of pereonite 6 not large, not overlapping those of pereonite 7. *Pleon* consisting of 4 visible segments (as determined by lateral sutures); pleonite 1 entire, posterior margin even, as wide as remainder of pleon, extending to pleon lateral margins; sutures (except first) running to lateral margin, all separate, long; pleonal sternite short relative to width; dorsal surface without process; posterior margin with plate-like extension, without 'keys'. *Pleotelson* flat, anteriorly as wide as pleon; posterior margin with two small submedian foramens; with hardened boss anterior to median notch, with ventral thickened rim; lateral margins forming ridge.

Antennule peduncle with basal articles medially not in contact, peduncle 1 and 2 robust, article 3 slender; inferior margin without hard cuticular spines; article 2 approximately 0.5 as long as article 1; with articles 2 and 3 colinear, article 3 longer than article 2; longer than peduncular article 3. *Antenna* peduncle articles less robust than antennule, peduncular articles all of similar thickness.

Epistome anteriorly narrow, with median constriction, elongate. *Mandible* incisor wide, multicuspid; lacinia mobilis present, tricuspid; molar process gnathal surface with transverse ridges, rounded. *Maxillule* lateral lobe RS with some or all serrate, mesial lobe with 4 major RS, these setae being heavily serrate. *Maxilla* with setae on middle and lateral lobes serrate. *Maxilliped* palp articles 2–4 medial margins extended, forming finger-like lobes, article 2 not expanded; endite distal margin truncate, without clubbed RS.

Pereopod 1 ambulatory. Pereopod 2 similar in proportion to pereopod 3. Pereopods with inferior margins of ischium to carpus not bearing dense setulose fringe; ischium superior margin with sinuate acute RS, pereopods 1–3 or 4 ischium superior margin without long stiff slender setae. Pereopods 1–3, inferior margins of merus, carpus and propodus palm with widely-spaced conspicuous RS along inferior margins. Dactylus of all pereopods with simple secondary unguis.

Penial processes entirely separate, basally in contact, short (not extending beyond pleopod peduncles), tapering smoothly from base, apex bluntly rounded.

Pleopod 1 rami not operculate; exopod lamellar, of similar proportions to exopod, longitudinal axis weakly oblique, mesial margin lamellar, proximomedial heel absent; exopod distally subtruncate, margins not serrate. *Pleopod 2* endopod about as long as exopod; exopod distal margins not deeply serrate; *appendix masculina* inserted basally, margins curving weakly to lateral, 1.25 times as long as endopod, distally bluntly rounded. *Pleopod 3* exopod transverse suture present; endopod of similar proportions to exopod. *Pleopod 4* rami without PMS; exopod transverse suture present, thickened transverse ridges absent, lateral margin not thickened, without short simple marginal setae; endopod thickened transverse ridges present, mesial margin without deep distal notch, without proximomedial lobe. *Pleopod 5* exopod transverse suture present, entire, thickened transverse ridges absent, lateral margin without short simple setae, not thickened, 3 discrete scale patches, scale patches forming protruding lobes. Pleopod 5 endopod with thickened transverse ridges absent, with proximomedial lobe.

Uropod rami not strongly flattened, not forming part of continuous body outline; exopod (of adult male) reduced, mobile, exopod round in section, inserted near midpoint of lateral margin of peduncle-endopod, distally with acute; endopod round in section, distally with hard terminal spike.

Female. Body surfaces densely setose. Pleon posterior margin not produced. Pleotelson dorsally domed, posterior margin obscurely trilobate, median lobe overriding lateral lobes, ventrally with single simple exit channel. Uropod rami flat, exopod about half as long as endopod; appendages otherwise similar to male.

No ovigerous females were present in the material but the close relationship of this genus to other genera in the *Cymodoce*-group of genera would strongly suggest that the mouthparts would be metamorphosed.

Remarks. Pooredoce gen. nov. can be identified by, in males, the cylindrical uropods, with the exopod smaller than the endopod, both rami being terminally acute, and the bi-perforate posterior pleotelson margin, which also has a median boss. Females have conspicuously setose dorsal surfaces, and that character together with the details of the uropods and pleotelson (as figured) serve to identify females in the absence of males.

Pooredoce is allied to a group of genera within the Sphaeromatidae characterised by a trilobate pleotelson posterior margin, the maxilliped palp articles 2–5 being greatly elongate ('finger-like'), the inferior margins of the merus–propodus of pereopods 1–3 with conspicuous robust setae, and uropods with a cylindrical in section endopod and a small exopod (50% or less than the length of the endopod) set about mid-length on the fused endopod peduncle. These genera in the broadest sense include the Indo-Pacific species of *Cymodoce* Leach, 1814 (see Harrison and Holdich 1984; Bruce 1997, generic remarks), *Oxinasphaera* Bruce, 1997 and *Koremasphaera* Bruce, 2003. In *Cymodoce* the uropodal exopod is flattened and comparatively larger than the other

genera mentioned; in *Koremasphaera* the trilobate pleotelson is scarcely evident. The *Cilicaea–Cilicaeopsis–Paracilicaea* group of genera share the maxilliped, pleotelson and pereopod characters but differ conspicuously to the other genera mentioned in having the uropodal exopod cylindrical in section and large, while the endopod is reduced to a small lobe (see figures in, for example, Harrison and Holdich 1984; Benvenuti and Messana 2000).

The pleotelson posterior margin of *Pooredoce* gen. nov. is complex, essentially trilobate, and conforming to the structure of 'two sub-median notches' or 'median notch with median process'. Such a pattern is present in the genera *Cymodoce*, *Cilicaea*, *Cilicaeopsis*, *Paracilicaea* (see Harrison and Holdich, 1984) and *Oxinasphaera* Bruce, 1997 (although *Cilicaeopsis* lacks a lobe within the median sinus). In the new genus the pleotelson lateral 'lobes' meet at the midline and the median lobe is posteriorly in contact with the lateral 'lobes' leaving the sinuses posteriorly closed off and forming two holes (figs. 1E–G).

This form of pleotelson, with the submedian sinuses posteriorly closed off, is not unique, occurring in the species *Cilicaea caniculata* (Thomson, 1879) (see Hurley and Jansen 1977). A pleotelson morphology approaching that of the new genus can be seen in some *Paracilicaea* Stebbing, 1910 such as *P. stebbingi* Baker, 1926 (see Harrison and Holdich 1984), *P. mirabilis* Benvenuti and Messana, 2000 and also in *Cilicaea calcarifera* Harrison and Holdich, 1984, but in all these species the submedian notches are posteriorly open. These genera are characterized by, among other characters, a uropod exopod that is round in section and the endopod reduced to a stub.

Pooredoce has one presumed derived or apomorphic character that is shared only with *Oxinasphaera*, that of the uropods having a cylindrical uropodal endopod and an exopod that is about half the length of the endopod and cylindrical or semi-cylindrical in shape; each ramus is tipped with a hardened 'spike'. *Koremasphaera* is similar, but the uropodal exopod is large, about as long as the endopod. *Oxinasphaera* is defined by the unique apomorphy of hardened spikes on the antennule peduncle; the present genus lacks these, but does have a unique and defining pleon and pleotelson morphology.

Pooredoce garyi sp. nov.

Figures 1–4

Material examined. Holotype, ♂ (4.1 mm), North Point, Lizard Island, 14.64553°S, 145.45335°E, 12 April 2008, from dead coral heads, 1.0–1.5 m, CReefs stn CGLI 20A, coll. N.L. Bruce, CReefs (MTQ–QM W30539).

Paratypes, ♂ (3.0 mm, immature), ♀ (non-ovig. 3.2, 3.0, 2.9 mm), juveniles (2.7, 2.5, 2.4, 2.4, 2.3 mm), same data as holotype (MTQ–QM W30540).

Additional material. ♂ (3.3 mm), ♀ (non-ovig. 2.9 mm), manca (1.9 mm), Hicks Reef, 14.44803°S, 145.49920°E, 21 February 2009, outer reef, dead coral heads on reef edge, 5.0–7.0 m, CReefs stn LIZ09-16E, coll. N. Bruce & M. Błażewicz-Paszkowycz. (MTQ–QM W31261).

Description of male. Body 1.8 times as long as greatest width, lateral margins subparallel, widest at pereonites 3–6; posterior dorsal raised transverse ridges surfaces granular, setose. Cephalon anterior margin without transverse ridges. Pereonite 1 about 1.2 times as long as pereonite 2; pereonites 2–6 subequal in length, pereonite 7 slightly shorter than 6.

Antennule peduncle article 1 1.7 times as long as wide, about 2.1 times as long as article 2; article 3 about half as long as article 1, 2.8 times as long as wide, 1.4 times as long as article 2; flagellum 9-articled, about 2.9 times as long article 3. *Antenna* peduncle article 1 short, articles 2 and 3 subequal in length, article 3 about 0.8 times as long as article 4; articles 4 0.7 as long as article 5; flagellum about 0.8 times as long as peduncle, extending to middle of margin of pereonite 1, with 9 articles.

Epistome anteriorly narrowly rounded, lateral margins with medial constriction; indistinct transverse ridge of nodules present. *Left mandible* incisor with 3 cusps, lacinia mobilis with 3 cusps, spine row of 3 curved, serrate spines; right mandible incisor with 3 cusps, spine row of 5 broad-based distally serrate spines; molar process round, crushing surface strongly ridged; palp article 1 1.2 as long as article 2 subequal, article 2 distolateral margin with 4 biserrate setae; article 3 with 8 biserrate setae, terminal seta being longest. *Maxillule* mesial lobe with 2 long, strongly CP, 2 long fringed and 2 short simple RS; lateral lobe with 10 broad-based, serrate RS and 1 curved, slender RS on gnathal surface, twelfth prominently pectinate seta set between these. *Maxilla* lateral lobe and middle lobe with 6 and 7 curved, pectinate RS respectively, mesial lobe with about 14 serrate and biserrate RS, proximal seta longest. *Maxilliped* endite lateral margin strongly convex, distal margin sub-truncate, with 8 sinuate CP RS, 1 blunt simple RS at sublateral angle, distomesial margin with 2 CP RS and single coupling hook; palp articles 2–5 with about 8, 8, 10 and 12 terminal setae respectively.

Pereopod 1 without setulose fringe on inferior margins; *basis* about 2.7 times as long as greatest width, approximately 2.3 as long as propodus; *ischium* 0.6 times as long as basis, 1.8 times as long as greatest width, superior margin with 2, sinuate, acute RS; *merus* about 0.5 times as long as ischium, about 1.2 times as long as greatest width, superior distal angle with 2 acute RS, inferior margin with 3 blunt RS distal-most being longest; *carpus* 0.8 times as long as wide, inferior margin with 2 RS, one blunt one acute; *propodus* 1.7 times as long as greatest width, 0.7 as long as ischium, inferior margin with 3 RS, 3 submarginal setae; *dactylus* 0.8 times as long as propodus, inferior margin with few simple scales. *Pereopod 2 basis* 2.7 times as long as greatest width, inferodistal angle with single long simple seta; *ischium* 0.8 times as long as basis, 2.5 times as long as greatest width, superior margin with 2 acute RS, distal inferior margin with 2 short acute RS; *merus* 0.5 as long as ischium, superior distal angle with 2 RS, inferior margin with 2 blunt RS; *carpus* 0.7 as long as merus, 1.2 times as long as wide, anterodistal angle with 1 RS, inferior margin with 2 blunt RS; *propodus* 0.6 times as long as ischium, 2.3 times as long as wide, superior distal angle with ~4 long simple seta and 1 sensory seta, inferior margin 1 acute RS and 2 submarginal setae; *dactylus* 0.6 as long as propodus, inferior margin distally with scales. *Pereopod 3* similar to pereopod 2. *Pereopods 5–7* similar. *Pereopod 7 basis* 3.2 times as long as greatest width, inferodistal angle with 1 long simple seta; *ischium* 0.9 times as long as basis, 3.2 times as long as greatest

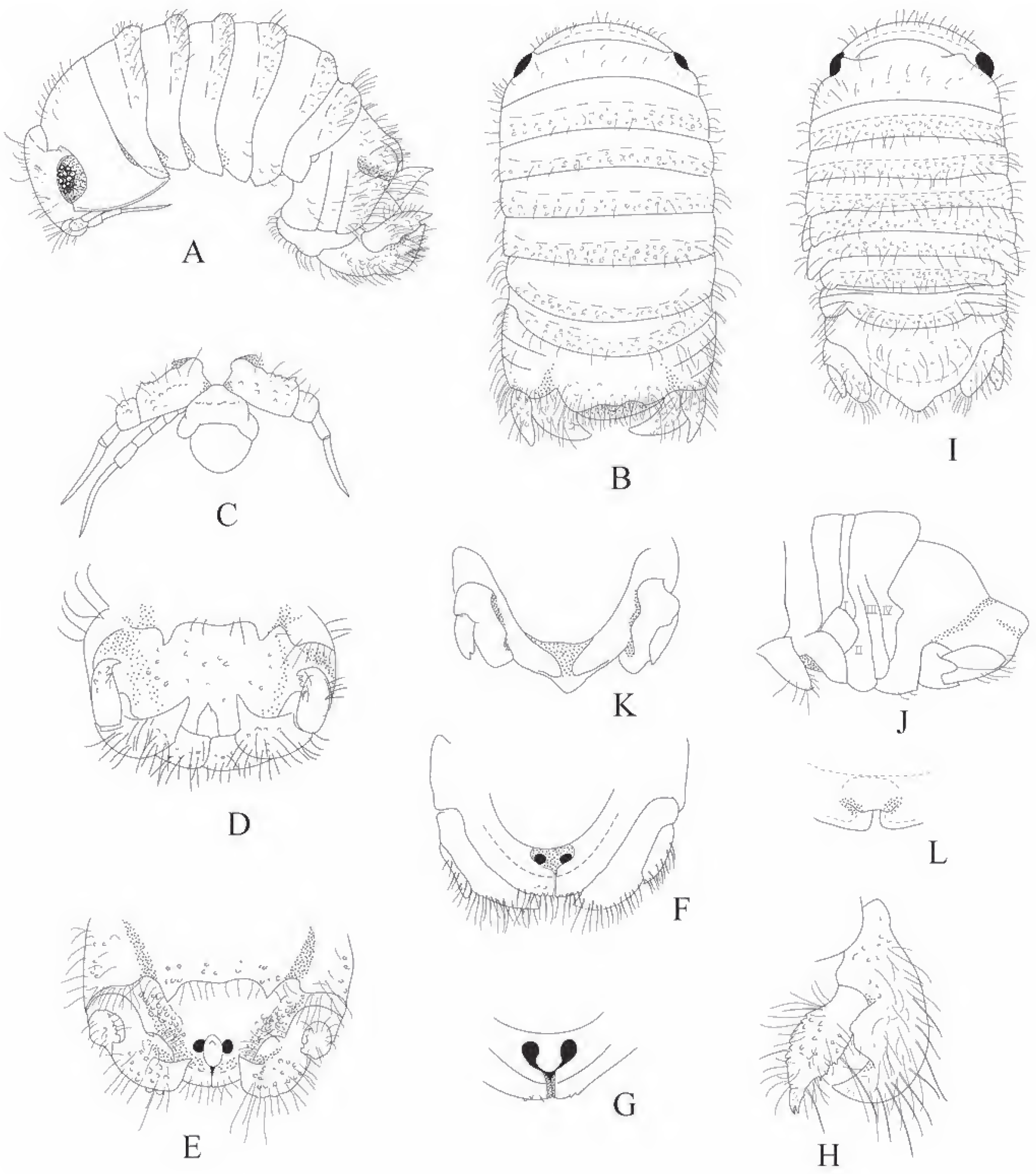

Figure 1. *Pooredoce garyi* sp. nov. A–H holotype, remainder ♀ 3.3 mm paratype. A, lateral view; B, dorsal view; C, epistome; D, pleon and pleotelson, posterior view; E, pleotelson, dorsal view; F, pleotelson, ventral view; G, pleotelson sinuses, ventral view; H, uropod; I, female, dorsal view; J, pleon and pleotelson, lateral view; K, pleotelson, ventral view; L, female pleotelson sinus, posterior view.

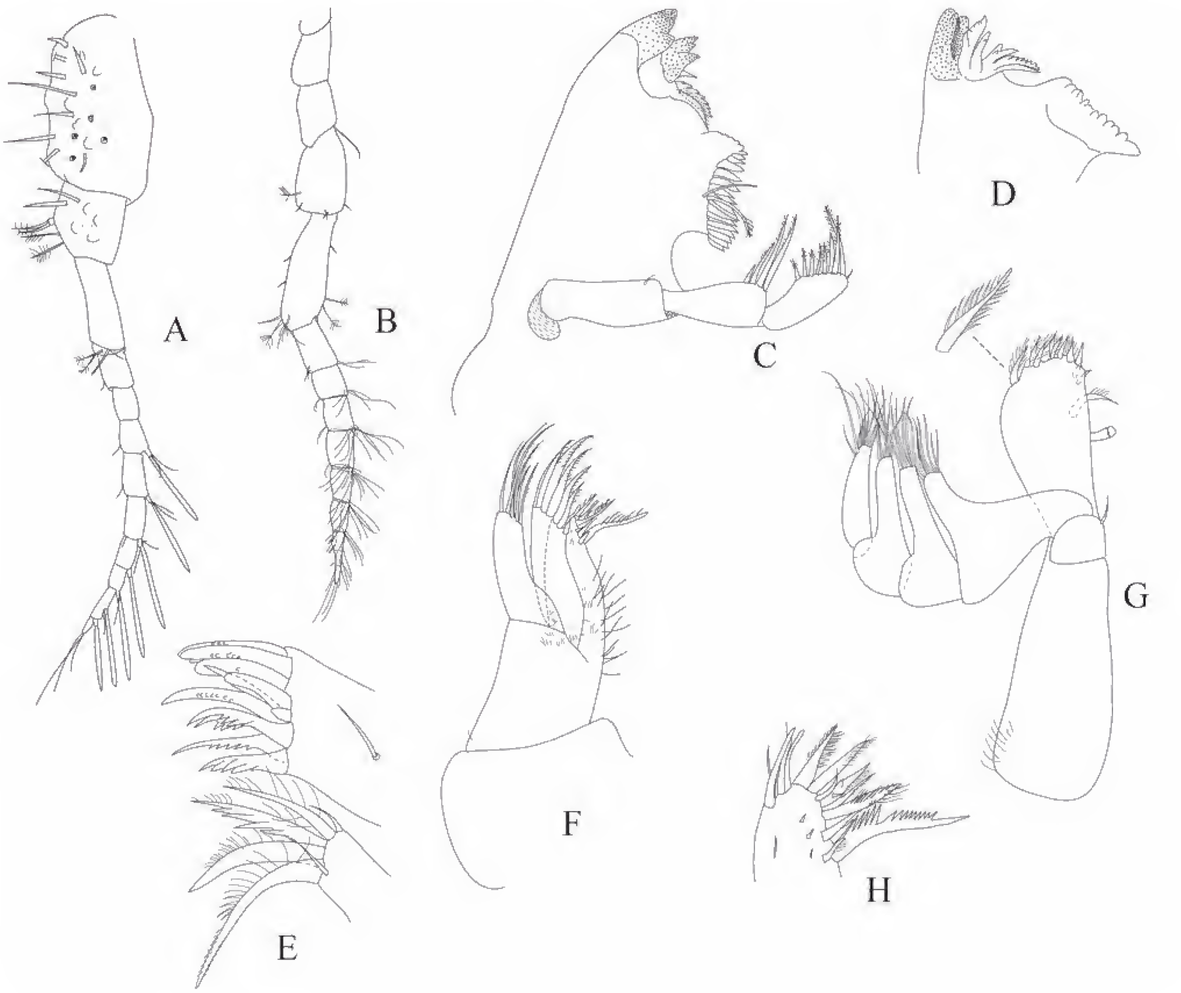

Figure 2. *Pooredoce garyi* sp. nov. A, B holotype, remainder ♂ 3.0 mm paratype. A, antennule; B, antenna; C, left mandible; D, right mandible incisor; E, maxillule; F, maxilla; G. maxilliped; H, maxilla mesial lobe.

width, superior margin with 4 sinuate, acute RS; *merus* 0.4 times as long as ischium, superior distal angle with 2 acute RS, inferior margin with 4 RS (3 acute, proximal RS blunt); *carpus* 0.8 times as long as merus, anterodistal margin with 5 acute serrate and biserrate RS, inferior distal angle with 4 RS, inferior margin with 1 RS; *propodus* 0.6 times as long as ischium, 2.9 times as long as wide, inferior margin with 2 RS, superior distal angle with 1 palmate seta and 3 simple setae; *dactylus* 0.5 as long as propodus.

Penes mutually adjacent, lateral margin distally convex, mesial margin weakly sinuate; approximately 3 times as long as basal width.

Pleopod 1 exopod and endopod with c. 32 and 20 PMS respectively, exopod proximolateral RS present; endopod and exopod subequal in length, endopod 1.4 times as long as greatest width, distal margin narrowly rounded. *Pleopod 2* exopod and endopod with c. 32 and 22 PMS respectively; *appendix masculin*a 8.7 times as long as basal width, apically narrowly rounded. *Pleopod 3* exopod and endopod with c. 27 and 9 PMS respectively; exopod transverse suture entire. *Pleopod 4* exopod lateral margin proximally with 4 evenly spaced fine simple setae; endopod with single distal seta. *Pleopod 5* endopod distal margin truncate.

Uropod (*in situ*) exopod about 0.5 as long as endopod, 3.1 times as long as greatest width, extending to endopod apex, margins converging to acute, finely bifid apex; endopod about 2.8 as long wide, curving medially, apex acute, curving dorsally; both with fine nodules and heavily setose.

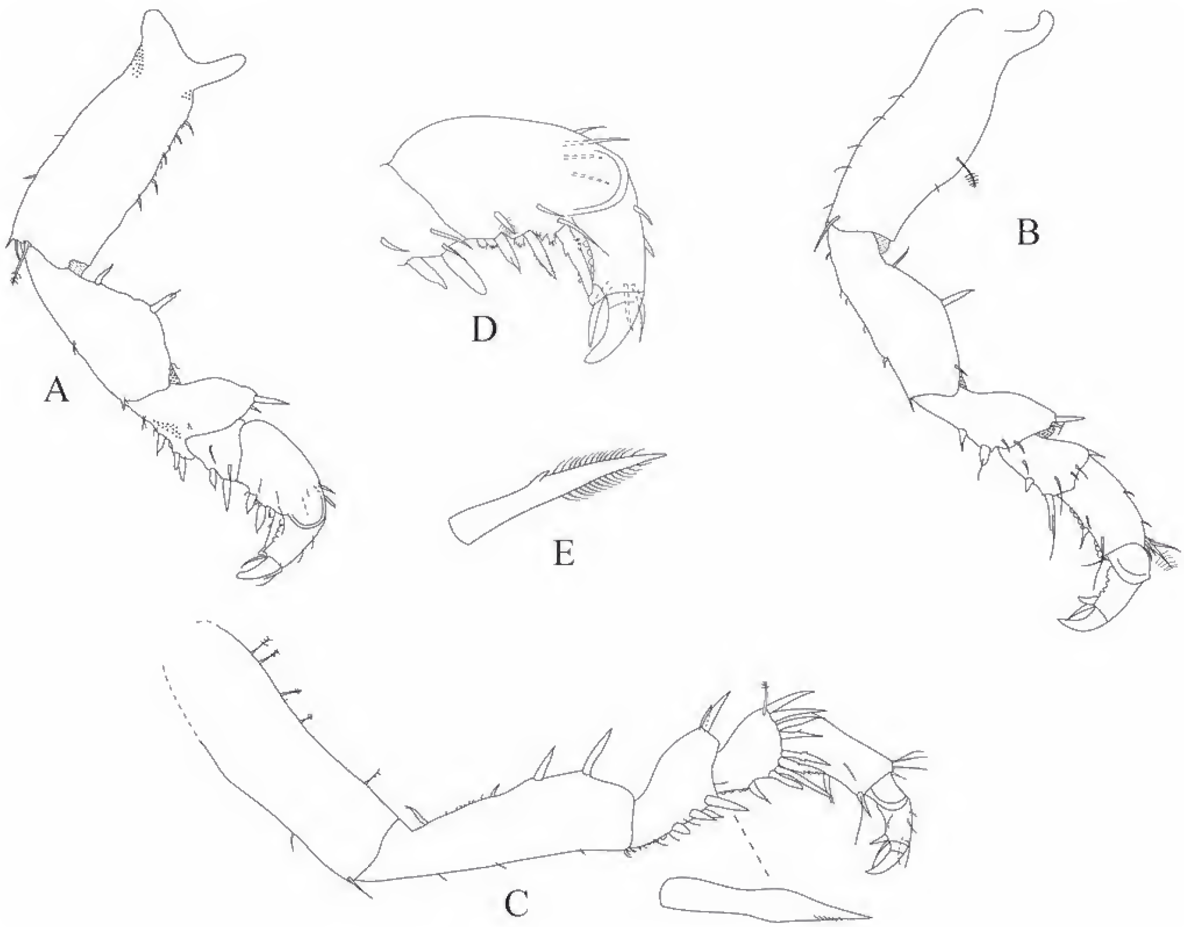

Figure 3. *Pooredoce garyi* sp. nov. Holotype. A–C, pereopods 1, 2 and 7 respectively; D, propodus and dactylus, pereopod 1; E, RS from inferodistal margin of carpus, pereopod 7.

Female. No ovigerous females present. Uropod endopod 2.8 as long as wide, posteriorly truncate; exopod 0.6 as long as endopod, 2.6 as long as wide, apically bifid, lateral side of apical division largest. Non-ovigerous females otherwise characterized by the generic characters.

Size. Adult males 3.3–4.1 mm; adult females 2.9–3.2 mm; juveniles 2.3–2.7 mm.

Remarks. Males can be identified by the generic characters, principally the unique pleotelson morphology in conjunction with the uropods. The females are rather similar to females of several other genera, notably *Cilicaea* and *Paracilicaea*, and are best identified by the very setose dorsal surfaces, the pleotelson posterior margin median notch appearing somewhat truncate and dorsal part being produced and overriding the lateral notches. Females of *Oxinasphaera* lack a distinct pleotelson notch.

Distribution. Northern Great Barrier Reef; on exposed reef edges from mid-shelf at Lizard Island and the outer reef front at Hicks Reef, intertidal to at least 7 m.

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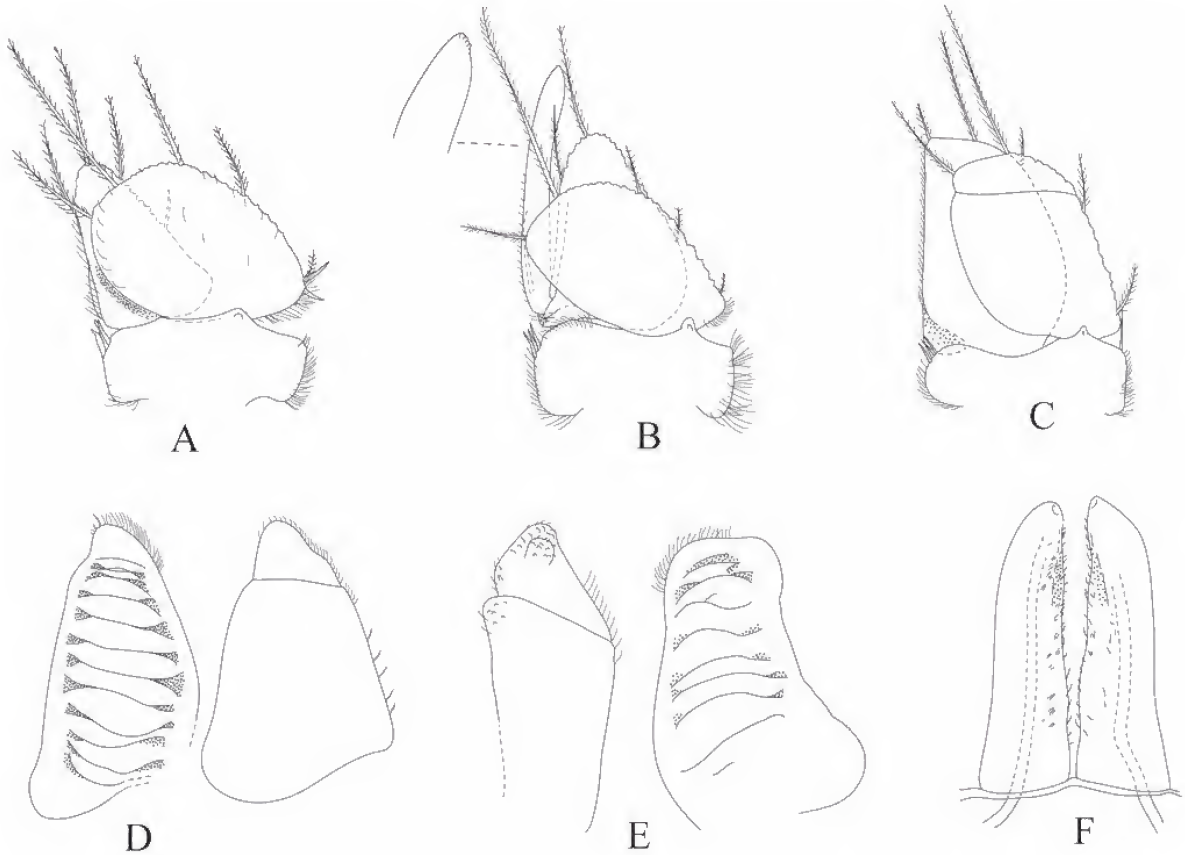

Figure 4. *Pooredoce garyi* sp. nov. Holotype except E, ♂ 3.0 mm paratype. A–E, pleopods 1–5 respectively; F, penes.

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Population biology of the ghost shrimps, *Trypaea australiensis* and *Biffarius arenosus* (Decapoda: Thalassinidea), in Western Port, Victoria.

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Abstract

Butler, S.N., Reid, M. & Bird, F.L. 2009. Population biology of the ghost shrimps, *Trypaea australiensis* and *Biffarius arenosus* (Decapoda: Thalassinidea), in Western Port, Victoria. *Memoirs of Museum Victoria* 66: 43–59.

This study compared the population biology of two co-existing species of ghost shrimps, *Trypaea australiensis* Dana 1952 and *Biffarius arenosus* (Poore 1975), over a two year period at Warneet and Crib Point in Western Port, Victoria, south-eastern Australia. Overall, the sex ratio in populations of *T. australiensis* varied considerably (male and female biases were found at different times) whereas the sex ratio of *B. arenosus* was generally 1:1 or female biased. A male biased sex ratio was found in the juvenile size class of populations of *T. australiensis* (both years) and *B. arenosus* (one year only). Both species reproduced in spring and summer in Western Port and juveniles appeared to recruit into the populations all year round. The embryo and clutch size of *T. australiensis* females was significantly larger than *B. arenosus*, and a significant relationship between female body size and clutch size (but not embryo size) was found for both species. Comparisons between this and other population studies of *T. australiensis* and *B. arenosus* were made to highlight any latitudinal variation in the reproduction and breeding biology of these species along the eastern coast of Australia.

Keywords Thalassinidea; ghost shrimp; Western Port; population biology; benthic invertebrates

Introduction

Thalassinidean ghost shrimps are considered key fauna in benthic habitats. There is significant interest in their influence on community composition of benthic environments (Branch and Pringle, 1987, Posey et al., 1991, Dittman, 1996, Berkenbusch et al., 2000) and their key role in changing sediment conditions (Abu-Hilal et al., 1988; de Vaugelas and Buscail, 1990; Forster and Graf, 1992; Bird et al., 2000; Katrak and Bird, 2003). Thalassinidean ghost shrimps have been identified as ecosystem engineers (Berkenbusch and Rowden, 2003) because bioturbation and bioirrigation of the sediment significantly alters its physical and chemical structure (Webb and Eyre, 2004; Grigg et al., 2007). Due to their important role in "engineering" the surrounding environment, thalassinidean ghost shrimps have been suggested as possible indicators of community composition and sediment properties (Posey, 1986; Nicholls, 2002). It is therefore important to fully understand their population biology, including the stability of populations, fecundity, sex ratios and reproductive periods.

The ghost shrimps, *Trypaea australiensis* and *Biffarius arenosus*, are distributed widely along the south and east coasts of Australia where they dominate benthic, soft-sediment marine habitats (Poore and Griffin, 1979). The population biology of *Trypaea australiensis* has been well studied in both northern and southern regions (Hailstone and Stephenson, 1961; Coleman, 1981; Kenway, 1981; McPhee and Skilleter, 2002a; Rotherham and West, 2007; Rotherham and West, 2009). In contrast, little is known about the population biology of *Biffarius arenosus*, with just one study carried out in the 1970s in Western Port, Victoria (see Coleman, 1981).

A comparison of studies of *T. australiensis* in north and south-eastern Australia provide evidence that biological measures such as fecundity and the timing of reproduction can vary for different populations of the same species of thalassinidean (Hailstone and Stephenson, 1961; Coleman, 1981; Kenway, 1981; McPhee and Skilleter, 2002a). Differences in the biology of spatially separated populations of invertebrate species have been reported for other species of thalassinidean. A study of *Callianassa filholi* found differences in the time and length of the reproduction period, the size of individuals at maturity and the rates of fecundity between populations from northern and southern New Zealand (Berkenbusch and Rowden, 2000). The primary cause of the variation was thought to be food availability at the different sites. In contrast, a number of studies (e.g. Kubo et al. (2006)) attributed latitudinal differences in thalassinidean embryo size amongst individuals of the same species to variations in water temperature. Differences in the size of individuals of *Upogebia africana* were related to variation in food availability and salinity of the water column (Hanekom and Erasmus, 1988). Given that the population biology of any given marine species can vary over space and time it is essential to understand the local population biology of species of ecological significance, such as ghost shrimps.

This study aims to describe the population biology of *T. australiensis* and *B. arenosus* in Western Port, Victoria and to compare the findings with previous studies. A particular focus is the population biology of *Biffarius arenosus* as very few studies have investigated the biology of this species. The population biology of *T. australiensis* is described here to compare with the other detailed studies from around Australia, particularly the recent work by Rotherham and West (2009). The opportunity to compare the biology of *T. australiensis* and *B. arenosus* of present day populations in Western Port, with the study by Coleman (1981) conducted 30 years ago provides the means to critically assess whether the population structure is consistent over time. Understanding the stability and variability in the population biology of these species in time and space is essential in order to consider ghost shrimps as key species or indicators of ecological condition in benthic habitats.

Methods

Sampling procedure

Individuals of the ghost shrimps *Trypaea australiensis* and *Biffarius arenosus* were collected from Warneet and Crib Point (38°13' S, 145°18' E), in Western Port, Victoria, Australia

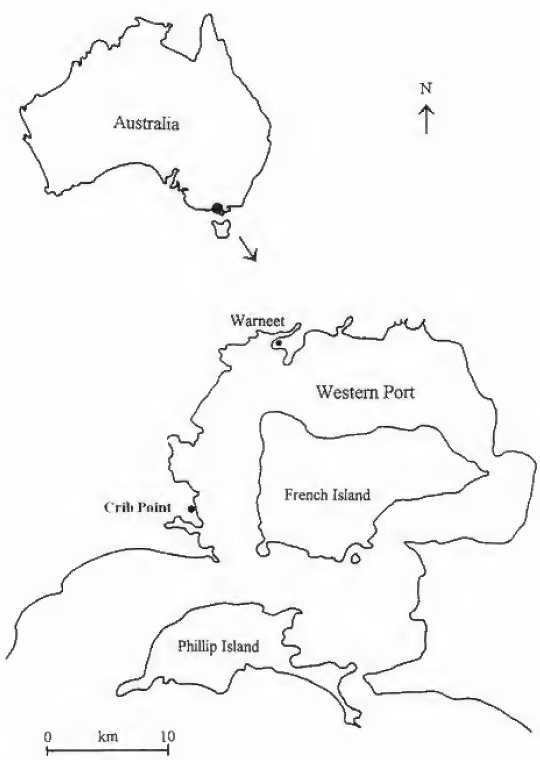

Figure 1. Map of Australia showing the study sites located in Western Port: Warneet and Crib Point.

(fig. 1). Individuals measured and examined for this population biology study were collected as part of a larger study, so methods of collection varied between years.

From April 2004 to March 2005, 6 large cores (25 cm diameter, 40 cm depth) were collected randomly along the mudflat between the high tide mark and the low tide mark at Warneet, once a month. Sediment within the cores was removed using a hand held suction pump, or bait pump. Sediment was directly pumped into a 1mm mesh sieve. All of the ghost shrimp individuals were collected from this sieve using forceps and placed in 70% ethanol for storage and analysis. From March 2006 to March 2007, ten medium cores (15 cm diameter, 40 cm depth) were collected from Warneet monthly. In April 2006 and then from October 2006 to April 2007 ten medium cores (15 cm diameter, 40 cm depth) were also collected each month from Crib Point, Western Port. Each core was removed intact and sediment from the cores was sieved through a 1 mm mesh sieve. All ghost shrimps were removed using forceps and stored in 70% ethanol for analysis. Frequent and intensive bait pumping for ghost shrimp was observed at Warneet during the 2006 sampling period so additional sampling was conducted at Crib Point to ensure individuals of all size classes, including large ovigerous females, were represented. Collection of ghost shrimps for bait can target larger individuals in a population (McPhee and Skilleter, 2002b), and therefore, the reduced period of sampling (seven months) was chosen to target individuals during the breeding season.

The variation in size of the cores used for collection in 2004/05 and 2006/07 may have impacted the number and size of individuals collected and therefore data from each year was analysed separately and general comparisons across years were made. Rotherham and West (2003) found that there was no significant difference in the catches of *Trypaea australiensis* or the precision of catches using two different sized cores (0.04 and 0.07 m^2), so it is presumed that comparisons in the current study across years will give a true representation of populations patterns despite the differences in core size used.

In the laboratory, all individuals collected in all samples were measured for carapace length (CL) and the sex was recorded. The sex was determined by the presence (female) or absence (male) of the 2nd pair of pleopods. The number of ovigerous females was recorded along with the development (eyed or uneyed) of the embryos. Carapace length was measured to 0.01 mm using a digital pair of callipers under a dissecting microscope, from the tip of the rostrum to the mid-dorsal posterior edge of the carapace.

Ovigerous females of *B. arenosus* and *T. australiensis* were selected with stage 1 embryos only (as described by Rodrigues (1976) (cited in Kubo et al. 2006)). Stage 1 embryos are tightly packed and round with a uniformly distributed yolk and no eye spots. Clutch size (CS, number of embryos per female) was quantified for each female by removing all embryos from the first and second pairs of pleopods under a dissecting microscope (magnification X 40). The shortest and longest diameters of the first 20 embryos from each female were measured under a compound microscope with a calibrated ocular micrometer (magnification X 40 or X 100). The formula

for an ellipsoid was used to calculate the volume of each embryo: Embryo volume $mm^3 = \pi LS^2/6$ (where L and S are the longest and shortest diameter respectively, measured to the nearest 0.01 mm). Mean embryo volume was calculated for each female. For comparison with data presented in Rotherham and West (2009), mean embryo diameter was calculated from all maximum and minimum embryo diameters measured for all individuals within a species.

Statistical analysis

Size frequency histograms and plots of the proportion of ovigerous females were created in Microsoft Excel 2007. Chi squared analyses were done using SPSS version 13.0 to statistically test if the sex ratio differed significantly from 1:1 for *T. australiensis* and *B. arenosus* overall for 2004-2005 and 2006-2007 and seasonally within these years. Sex ratio was compared at Warneet and Crib Point separately and for juveniles and adults separately.

Size cohorts were identified for *T. australiensis* and *B. arenosus* each month (or sampling period) using Bhattacharya's (1967) graphical method of fitting normal (Guassian) components to length-frequency histograms with the modal progression analysis routine in the computer program FISAT II (FAO-ICLARM, 2005). Visually estimated cohort means (as obtained with Bhattacharya's method in FISAT II) were then refined using the NORMSEP optimisation procedure in FISAT II. No progression of the cohort means was observed for data collected for either *T. australiensis* or *B. arenosus* each month indicating that individuals collected each month were not from the same cohort. Consequently, no further analysis of growth from length-frequency data was conducted. Instead, the cohort means calculated for each month were represented with an arrow on the length-frequency histograms for each species and each year.

The clutch size and mean embryo volumes of ovigerous females were compared between species using t-tests in SPSS version 15.0. Data for these parameters were normally distributed (Shapiro-Wilks test, $p > 0.05$) but tests for equality of variance (Levene's test) showed variances were not equal ($p < 0.05$). Despite variance not being equal, t-tests were still used but the significance level was reduced to $p<0.001$ to reduced the chance of a type I error occurring. The relationships between embryo volume, clutch size and carapace length (as CL^3) were explored for both species using a Pearson's product-moment correlation. The significant relationship between clutch size to carapace length (as CL^3) was then analysed using linear regression. The line of best fit for each significant linear relationship was plotted.

Results

Population structure of Trypaea australiensis

In 2004-2005, a total of 712 *Trypaea australiensis* were collected across the 12 months. Of these, 600 specimens could be sexed. There were 347 males and 253 females resulting in an overall sex ratio of 1.4:1 (males: females) which was significantly different from 1:1 ($\chi^2 = 14.727$, df = 1, $p < 0.001$). When considering juveniles and adults separately the overall sex ratio was 4.8:1 (males: females) for juveniles ($\chi^2 = 88.862$, df = 1, $p < 0.001$) and for 0.69:1 (males: females) for adults ($\chi^2 = 11.174$, df = 1, $p = 0.001$) both significantly different from 1:1. Seasonally, there were generally two cohorts of *T. australiensis,* one with a mean carapace length between 3-5 mm and the other cohort at mean carapace length between 7-10 mm (fig. 2, see arrows). The smaller cohort (presumably juvenile *T. australiensis*) can be detected using Bhattacharya's method in all months except April, June, August, September and January 2004-2005. However, juveniles also seem to be present (though not normally distributed) in April, July, August and September. This suggests recruitment into the population throughout the year. From April to September 2004 there was a significant sex bias towards males (13.7:1, 16:0, 15.5:1, 3.9:1, 3.5:1, 4:0 respectively) in juvenile (CL < 5 mm) *T. australiensis* (χ^2 = 32.818, 16.00, 25.485, 11.765, 5.556, 11.560, $p < 0.05$ respectively) but not adult *T. australiensis* until August where the sex bias was towards females 0.4:1 ($\chi^2 = 6.429$, df = 1, $p = 0.011$). In September 2004, only four juveniles were collected and these were all males, however there was a significant sex biased towards females in adults 0.2:1 (males: females) ($\chi^2 = 11.560$, df = 1, $p = 0.001$). From October 2004 to March 2005 the sex ratio did not differ significantly from 1:1, although juveniles in March 2005 did show a sex ratio significantly different from 1:1 with a bias towards males (7.5:1, $\chi^2 = 9.941$, df = 1, $p = 0.002$).In 2006-2007, a total of 381 *T. australiensis* were collected across ten months at Warneet. Of these 212 were males and 169 were females resulting in a male sex bias of 1.3:1 which was significantly different from 1:1 ($\chi^2 = 5.765$, df = 1, $p = 0.016$). When considering juveniles and adults separately out of 90 juveniles collected there was no significant difference in the sex ratio from 1:1 ($p = 0.206$) however, there was a significant sex bias towards males (1.3:1) for the 291 adults ($\chi^2 = 4.167$, df = 1, $p = 0.041$). Seasonally throughout 2006-2007 at Warneet, the sex ratio for *T. australiensis* seemed to vary as in 2004-2005, however when tested with a chi-square test there was no significant deviation in the sex ratio from 1:1 in any month for adults or juveniles ($p > 0.05$) except in September 2006 when adult males outnumbered adult females 4.3:1 ($\chi^2 = 6.250$, df = 1, $p = 0.012$). In 2006-2007 at Warneet, the two distinct cohorts seen in 2004-2005 were again apparent in all months except December 2006 however a bimodal size distribution was not as clear (see arrows on fig. 3). In August 2006, there were three cohorts identified with the third cohort of mean carapace length 9-10 mm. Higher numbers of juveniles (CL < 5 mm) were seen in May 2006 and February 2007 although the juveniles or smallest cohort (CL 3-4 mm) were present in May, July, August, September and February (fig. 3) indicating some recruitment throughout the entire sampling period. At Crib Point in 2006-2007, a total of 386 *T. australiensis* were collected across seven months. Of these shrimps 225 were males and 161 were females resulting in a sex ratio of 1.4:1 (males: females) which was significantly different from 1:1 (χ^2 10.611, df = 1, $p = 0.001$). For juveniles and adults separately at Crib Point, there was no significant difference in the sex ratio of adults from 1:1 ($p > 0.05$) but there was a significant difference in the sex ratio of juveniles from 1:1. For juvenile *T. australiensis* at Crib Point, the sex ratio was significantly male biased (1.8:1, $\chi^2 = 11.267$, df

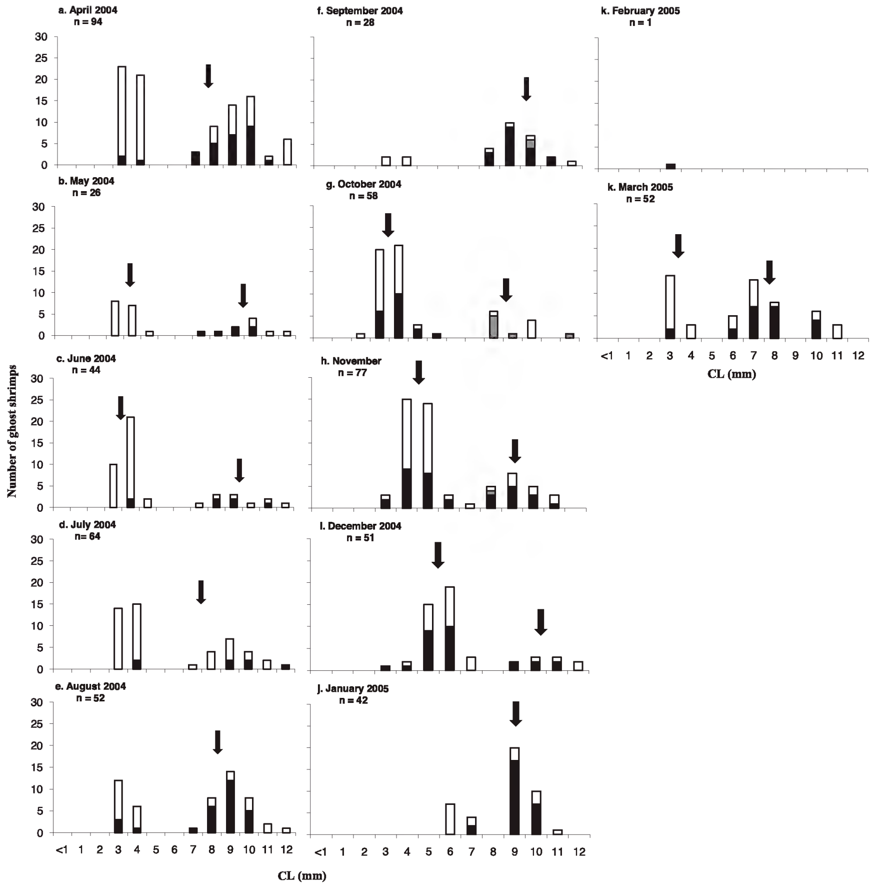

Figure 2. Carapace length (CL) size frequency distributions for *Trypaea australiensis* collected at Warneet, Western Port in 2004-2005. Non-ovigerous females are shown by black bars, ovigerous females by grey bars and males by open bars (n = number of shrimp collected). Individuals are grouped into size classes by rounding to the closest mm from two decimal places. Arrows show mean CL length of the cohorts identified using FISAT II

= 1, p = 0.001). When each sampling occasion was considered separately, it was found that the sex ratio did not differ from 1:1 ($p > 0.05$) for any sampling occasion except for juveniles in April 2006. In April 2006 at Crib Point, the juvenile sex ratio was significantly male biased (4.8:1, 15.114, df = 1, $p < 0.001$). At Crib Point there was generally only one cohort of individuals identified through graphical methods, except in February and April 2007 where there were two cohorts identified with mean carapace lengths of 4-5 and 7-8 mm (fig. 4). Although generally only one cohort was identified graphically at Crib Point, there were small individuals (< 5mm CL) present in all months.

Overall the sex ratio for *T. australiensis* populations at Warneet in 2004-2005 and at Crib Point in 2006-2007 was the same (1.4 males: 1 female). The overall sex ratio at Warneet 2006-2007 was also very similar (1.3 males: 1 female) indicating some consistencies in these populations across years and sites.

Reproduction of Trypaea australiensis

In 2004-2005, a low proportion of ovigerous females (10 out of 248 females) were collected. These ovigerous females were found in September, October and November 2004 (fig. 5a). During this period, ovigerous females had uneyed (early development) and eyed (late development) embryos.

In 2006-2007, a total of 19 ovigerous females out of 169 females were collected at Warneet. These ovigerous females were found in a similar period to 2004-2005, which was September, November and December 2006, although there was a higher proportion of ovigerous females found in November and December 2006 than in November and December 2004 (fig. 5c). The ovigerous females in September carried early stage developed embryos with no eyes while the later ovigerous females collected in November and December had late stage developed embryos with clear eyes. At Crib

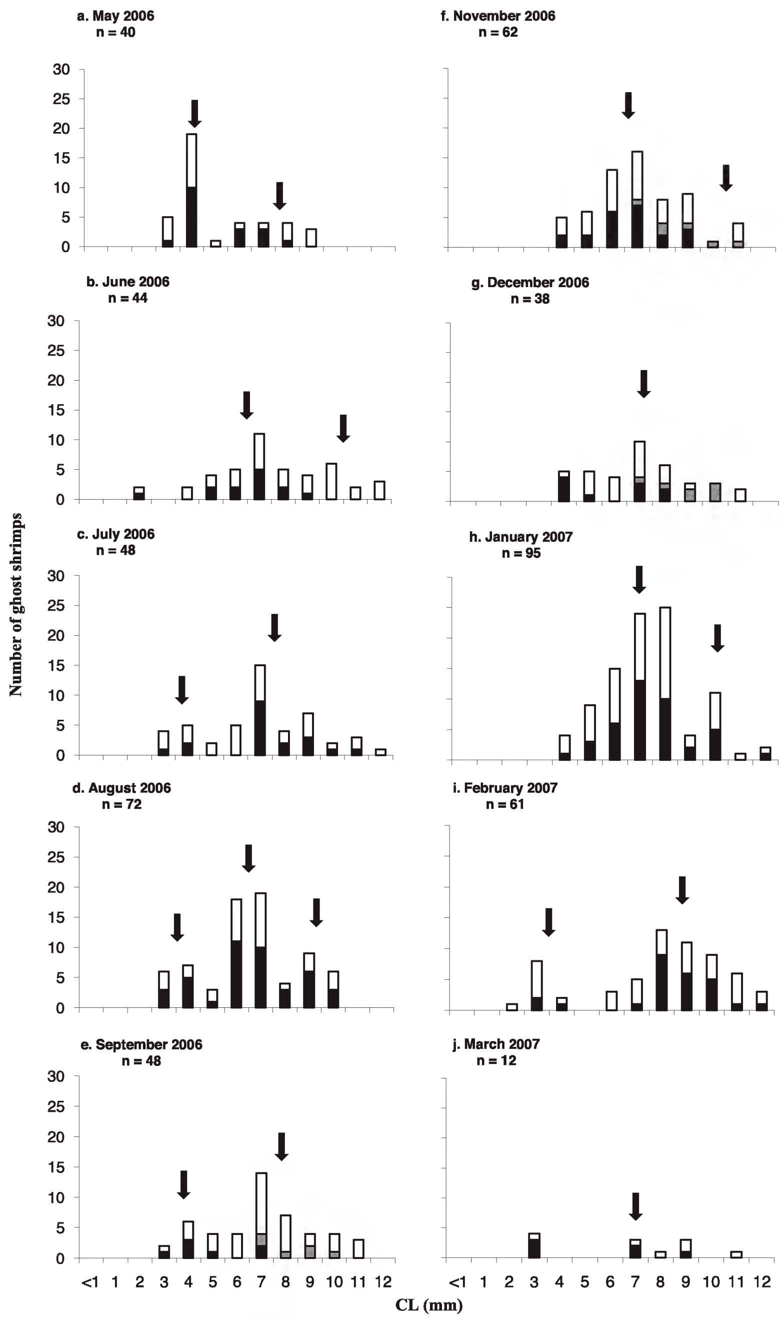

Figure 3. Carapace length (CL) size frequency distributions for *Trypaea australiensis* collected at Warneet, Western Port in 2006-2007. Non-ovigerous females are shown by black bars, ovigerous females by grey bars and males by open bars (n = number of shrimp collected). Individuals are grouped into size classes by rounding to the closest mm from two decimal places. Arrows show the mean CL length of cohorts identified using FISAT II.

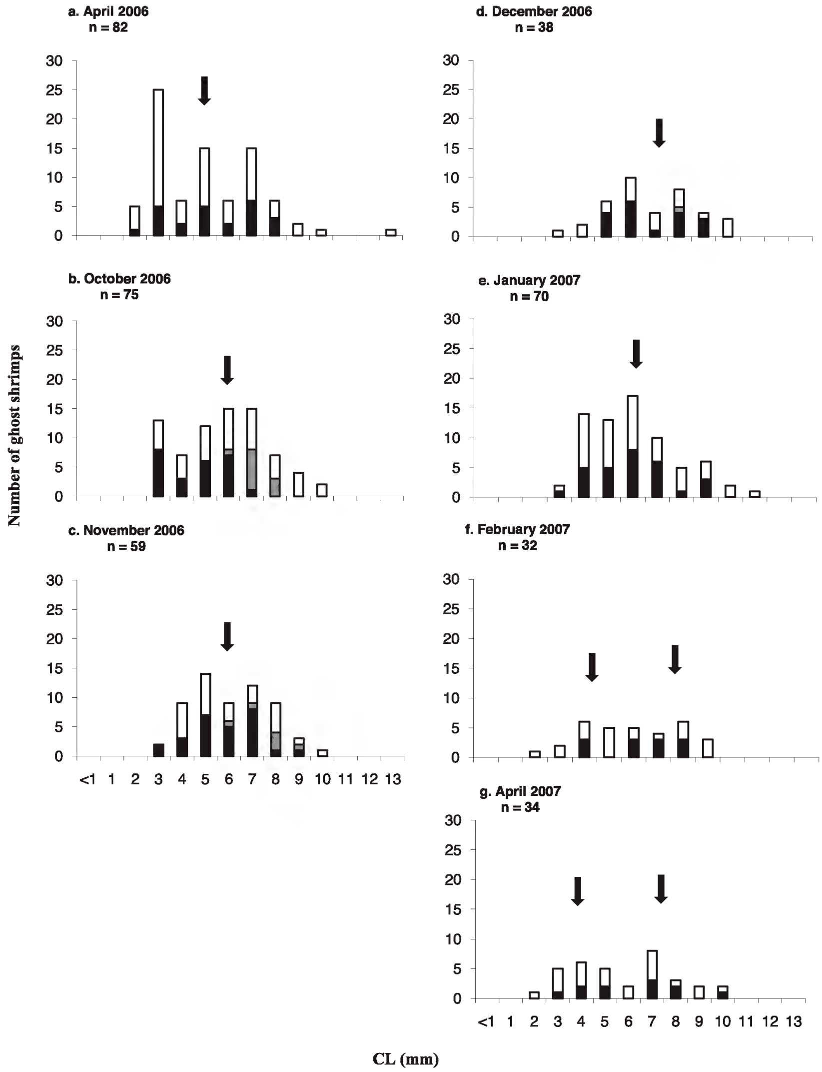

Figure 4. Carapace length (CL) size frequency distributions for *Trypaea australiensis* collected at Crib Point, Western Port in 2006-2007. Non-ovigerous females are shown by black bars, ovigerous females by grey bars and males by open bars (n = number of shrimp collected). Individuals are grouped into size classes by rounding to the closest mm from two decimal places. Arrows show mean CL of the cohorts using FISAT II.

Point, a total of 18 ovigerous females out of 161 females were collected. These ovigerous females were found in October, November and December 2006 again the same period as at Warneet in 2004-2005 and 2006-2007 (fig. 5e).

Population structure of Biffarius arenosus

In 2004-2005 a total of 436 *Biffarius arenosus* individuals were collected across 12 months. Of these 368 specimens could be sexed. There were 185 males and 183 females resulting in a sex ratio of 1:1 (males: females). When considering juveniles (CL < 3mm) and adults separately it was found that there was a sex ratio of 2.3:1 (males: females) for juveniles which is significantly different from 1:1 (χ^2 = 8.643, df = 1, p = 0.003). There was no significant difference in sex ratio from 1:1 in adult *B. arenosus* individuals. Seasonally in 2004-2005, the sex ratio rarely deviated from 1:1 (males: females). There was a significant male sex bias in juveniles in March 2004 (6:0, χ^2 = 6, df = 1, p = 0.014) however this is most likely due to very few juveniles being collected. In January 2005, there was a significant female sex bias in adult *B. arenosus* (8:0, χ^2

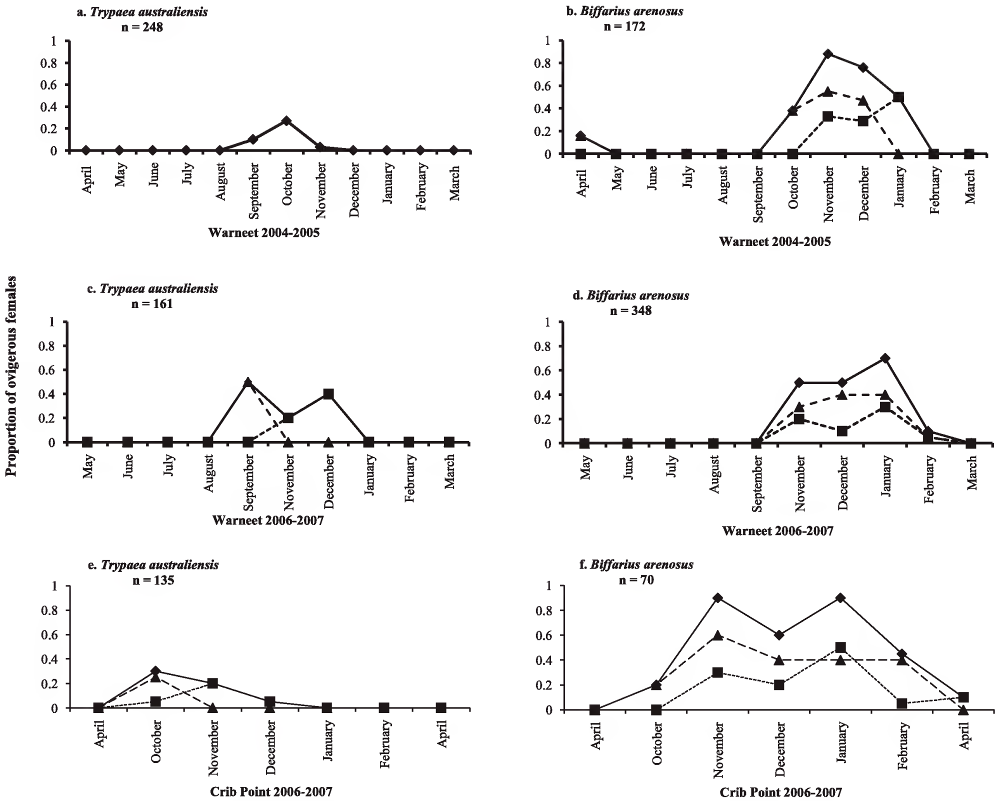

Figure 5. Proportion of ovigerous females for April 2004 to March 2005 (a. *Trypaea australiensis*, b *Biffarius arenosus*) and March 2006 to May 2007 (c. *T. australiensis*, d. *B. arenosus*) at Warneet, Western Point. Proportion of ovigerous females for April 2006, October 2006 - February 2007 and April 2007 (e. *T. australiensis*, f. *B. arenosus*) at Crib Point, Western Port. Solid line is total proportions of ovigerous females, triangles with dashed line is proportion of ovigerous females with uneyed embryos and squares with dashed line is proportion of ovigerous females with eyed embryos.

= 8, df = 1, p = 0.005), however as with the juveniles in March, the sex ratio is most likely due to only eight individuals being collected. Throughout the 12 month period there only seemed to be one cohort of individuals (CL 4-5mm, fig. 6). Juveniles (CL < 3mm) were present in all months indicating recruitment into the population throughout the sampling period (fig. 6).

In 2006-2007 a total of 631 *B. arenosus* individuals were collected at Warneet of which 283 were males and 348 were females. This was a sex bias towards females (0.8:1 males: females) which was significantly different from 1:1 ($\chi^2 = 6.696$, df = 1, p = 0.010). Overall of the 239 juveniles there was a sex ratio of 1.1:1 (males: females) which was not significantly different from 1:1 ($p > 0.05$) and of the 388 adults there was a sex ratio of 0.7:1 (males: females) which was significantly different from 1:1 ($\chi^2 = 12.629$, df = 1, $p < 0.001$). Seasonally at Warneet there was a significant sex biased towards males for juvenile *B. arenosus* in January 2007 (5:1, $\chi^2 = 5.333$, df = 1, p = 0.021) and a significant biased in the sex ratio towards females for adults in January 2007 (0.5:1, $\chi^2 = 5.000$, df = 1, p = 0.025) and in February 2007 (0.5:1, $\chi^2 = 5.453$, df =1, p = 0.020). There were no other sampling times at Warneet in which the sex ratio was significantly different from 1:1. As in 2004-2005, there appears to be only one cohort of individuals of *B. arenosus* throughout the sampling period in 2006-2007 at Warneet (CL 4-5 mm, fig. 7 see arrows) with juveniles (CL < 3 mm) present at all sampling periods.

At Crib Point in 2006-2007, a total of 140 *B. arenosus* individuals were collected across seven months. Of these 138 specimens could be sexed. There were 57 males and 81 were females resulting in a female biased sex ratio of 0.7:1 (males: females) which was significantly different from 1:1 ($\chi^2 = 4.174$, df = 1, p = 0.041). For juveniles and adults separately at Crib Point, there was no significant difference in the sex ratio of juveniles from 1:1 ($p > 0.05$) but there was a significant difference in the sex ratio of adults from 1:1 resulting in a female bias (0.56:1, $\chi^2 = 9.308$, df = 1, p = 0.002). When each sampling occasion was considered separately at Crib Point, it was found that the sex ratio did not differ from 1:1 ($p > 0.05$) for any sampling occasion. When comparing the size frequency histograms for *B. arenosus* at Crib Point it can be seen that there was only one cohort of individuals present each month (CL 4-5

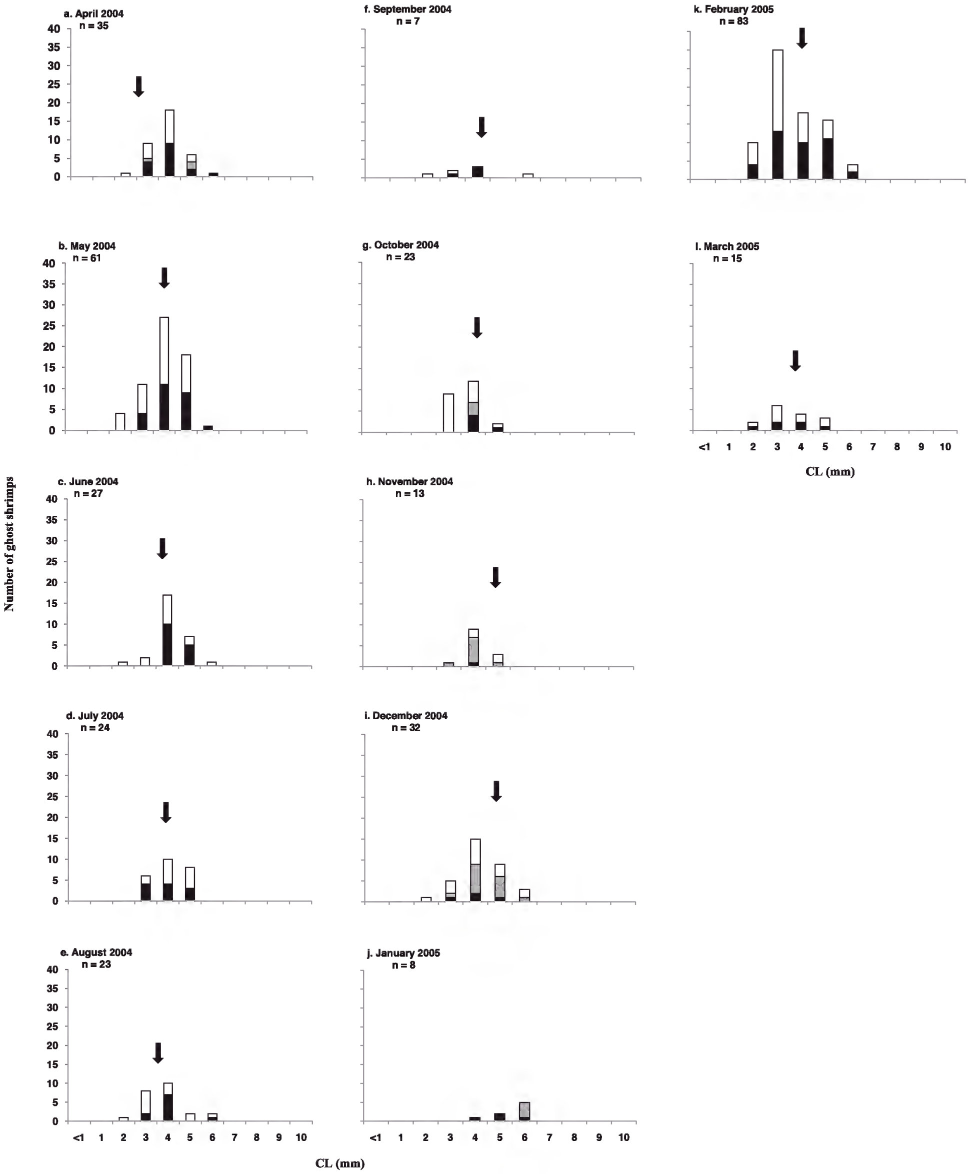

Figure 6. Carapace length (CL) size frequency distributions for *Biffarius arenosus* collected at Warneet, Western Port in 2004-2005. Non-ovigerous females are shown by black bars, ovigerous females by grey bars and males by open bars (n = number of shrimp collected). Individuals are grouped into size classes by rounding to the closest mm from two decimal places. Arrows show mean CL of cohorts as calculated in FISAT II.

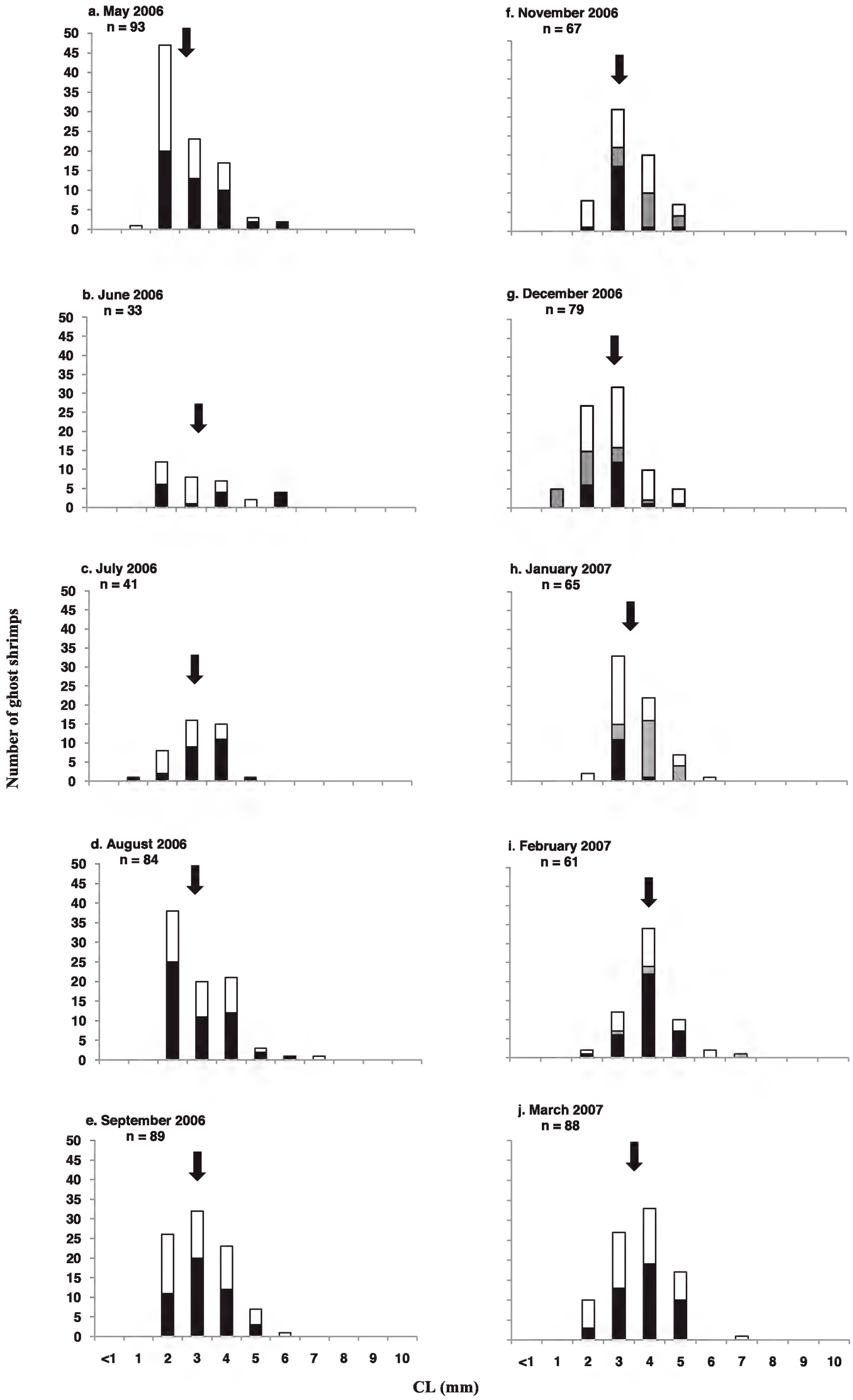

Figure 7. Carapace length (CL) size frequency distributions for *Biffarius arenosus* collected at Warneet, Western Port in 2006-2007. Non-ovigerous females are shown by black bars, ovigerous females by grey bars and males by open bars (n = number of shrimp collected). Individuals are grouped into size classes by rounding to the closest mm from two decimal places. Arrows indicate mean CL of cohorts calculated in FISAT II.

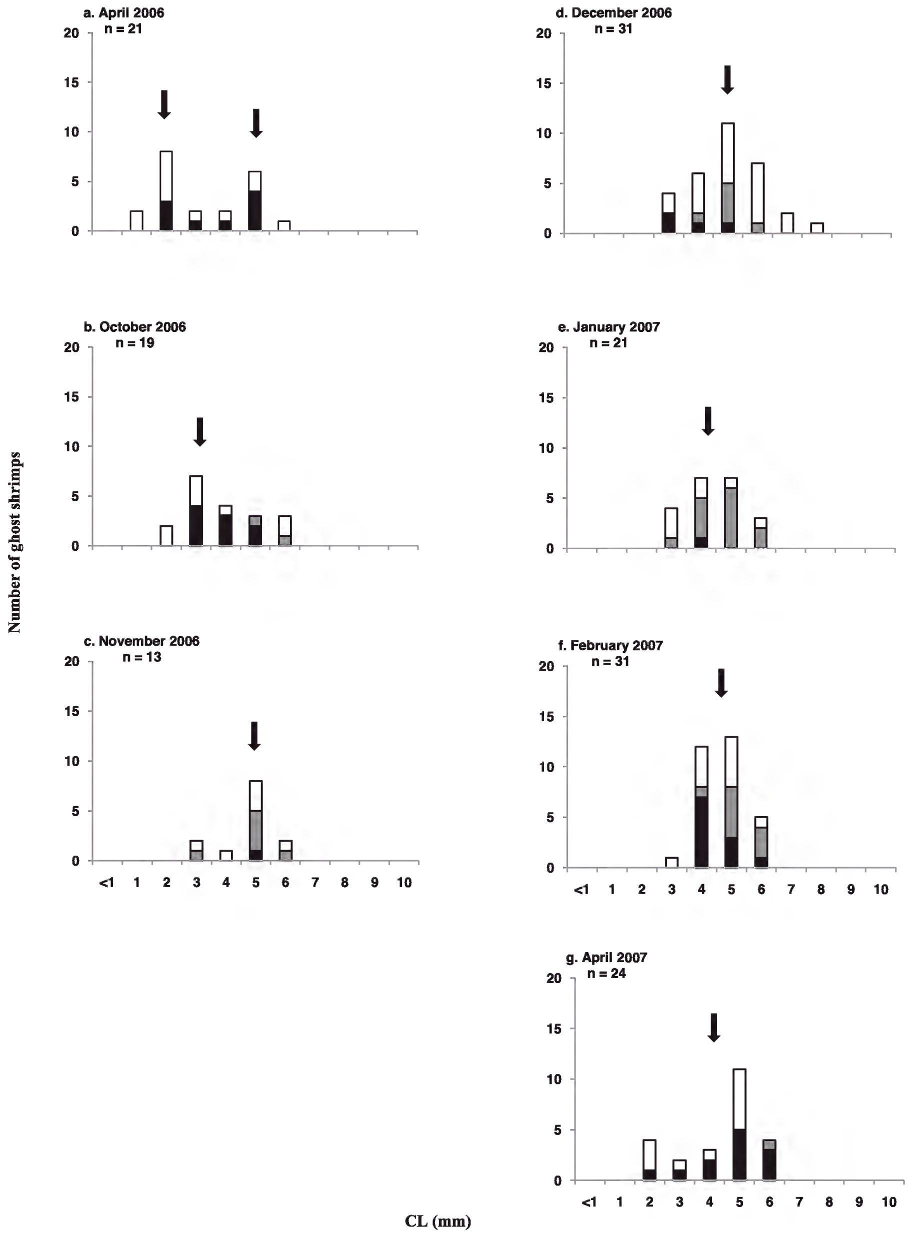

Figure 8. Carapace length (CL) size frequency distributions for *Biffarius arenosus* collected at Crib Point, Western Port in 2006-2007. Non-ovigerous females are shown by black bars, ovigerous females by grey bars and males by open bars (n = number of shrimp collected). Individuals are grouped into size classes by rounding to the closest mm from two decimal places. Arrows show mean CL for cohorts as calculated in FISAT II.

mm, fig. 8, see arrows) except in April 2007 where there were two cohorts identified at mean carapace length 2-3mm and 5-6mm. This second cohort may represent a higher number of juveniles entering these populations in this month. The other months are consistent with data from Warneet, indicating a similar size structure in the populations from both sites.

Overall in 2004-2005 and 2006-2007 at Warneet, there was little change in the sex ratio of *B. arenosus* both overall and throughout time (1:1, 0.8:1 and 0.7:1 respectively). There was also only one cohort of individuals throughout the sampling periods and juveniles were present in most samples.

Reproduction of Biffarius arenosus

In 2004-2005 a total of 31 ovigerous females out of 172 females were collected. The reproductive period, as represented by the presence of ovigerous females, occurred with a small peak in April 2004 and then from September 2004 to February 2005 (fig. 5b). There was a clear succession in the presence of ovigerous females with early stage developed (eyed) embryos and ovigerous females with late stage developed (uneyed) embryos. Eyed embryos were present on ovigerous females from September to January with a peak in November while uneyed embryos were present on females from October to February with a peak in February (fig. 5b).

In 2006-2007 at Warneet a total of 63 ovigerous females out of 348 females were collected. The reproductive period occurred from September 2006 to March 2007 (fig. 5d). This is the same pattern as occurred in 2004-2005 however the reproductive period was slightly longer with ovigerous females present in January and February in 2007. The succession in the stage of embryo development seen in 2004-2005 was not as apparent in 2006-2007 with uneyed embryos present on females from November to March and eyed embryos present also from November to March (fig. 5d). At Crib Point there were 24 ovigerous females out of a total of 81 females collected in 2006-2007 and the period of ovigerous females was generally consistent with 2004-2005 and 2006-2007 at Warneet. Ovigerous females were found at Crib Point from October 2006 to February 2007 and again in April 2007 (fig. 5f).

Embryo and clutch size

Embryo size (expressed as volume, mm^3) for *T. australiensis* (mean ±SD = 0.33 ±0.05 mm^3, n = 380) was significantly larger than for *B. arenosus* (0.10 ±0.02 mm^3, n= 400) (t- test; t=19.1, n = 37, $p < 0.001$). The relationships between embryo volume (mm^3) and female body size (as carapace length, mm) for both *B. arenosus* and *T. australiensis* are shown in fig. 9. The correlations between embryo volume and total length (r = 0.249 for *B. arenosus* and r = -0.047 for *T. australiensis*) were not significant ($p > 0.05$).

The mean clutch size for *T. australiensis* (313 ± 226) was significantly larger than for *B. arenosus* (96 ± 54) (t test; t = 4.7, df = 37, $p < 0.001$). A significant relationship between clutch size and female body size (as carapace length, mm) was detected for both *B. arenosus* (ANOVA; F = 20.62, df = 18, $p < 0.001$, r^2 = 0.51) and *T. australiensis* (ANOVA; F = 53.09, df = 17, $p < 0.001$, r^2 = 0.74) (fig. 10). The linear regression equations for *B. arenosus* (y = 1.38 x – 22.03) and *T. australiensis* (y = 0.82 x – 241.66) describe the relationship between clutch size and female body size for each species.

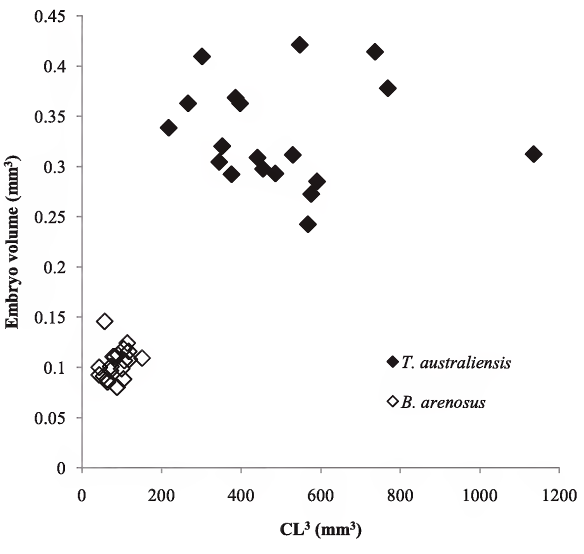

Figure 9. Relationships between embryo volume (mm^3) and body size (CL^3 = carapace length^3) for females of *Trypaea australiensis* and *Biffarius arenosus*. Embryos were from females collected from March 2006 to May 2007 at Warneet and Crib Point, Western Port.

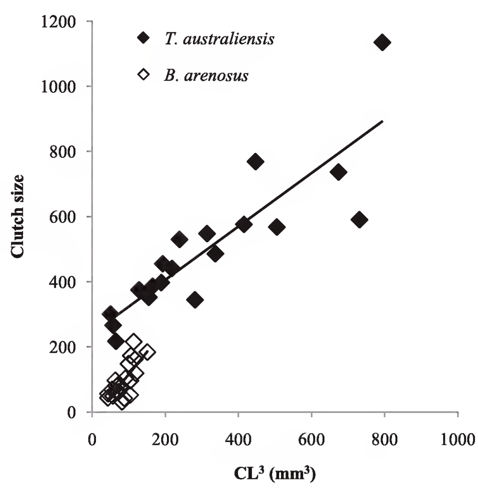

Figure 10. Linear regression of clutch size (number of embryos per female) and body size (CL^3 = carapace length^3) for females of *Trypaea australiensis* and *Biffarius arenosus*. Females were from March 2006 to May 2007 sampling at Warneet and Crib Point, Western Port.

Table 1. Comparison of the size of the smallest male and female, the largest male and female, the smallest ovigerous female, the mean embryo size (uneyed) (diameter and volume), the clutch size range, the reproductive period (by presence of ovigerous females), season at time of reproduction (main reproductive season) and the presence of juveniles for *Trypaea australiensis* collected in a number of studies throughout Australia. All size measurements are for carapace length (CL) in mm.

Locality	Western Port, Victoria	Western Port, Victoria	Moreton Bay, Queensland	Western Port, Victoria	Cleveland Bay, North Queensland	Moreton Bay, Queensland	Port Hacking, New South Wales	Shoalhaven River, New South Wales	Moruya River, New South Wales
Smallest male collected (CL mm)	2-3	2-3	3-5	2-3	3 - 6*	-	2	2	2
Smallest female collected (CL mm)	3-4	2-3	3-5	3-4	4 - 6*	-	3	3	3
Largest male collected (CL mm)	12	12	16	14-15	15*	-	14	15	11
Largest female collected (CL mm)	12	12	15	11-12	16*	-	12	13	10
Smallest ovigerous female collected (CL mm)	8	7	8	5-6	5*	3	7	6	5
Embryo volume (mm^3)	-	0.19-0.63	-	-	-	-	-	-	-
Embryo diameter (mm)	-	0.70-1.16	-	-	-	-	-	-	-
Mean embryo diameter (mm)	-	0.87	-	-	-	-	0.61	0.67	0.61
Clutch size (range)	-	50-793	-	-	92-2236	-	723-3259	663-4738	636-1363
Reproductive period	Aug-Dec	Aug-Jan	Mar-Nov - with peaks in April and Sept	Aug - Jan - with a major peak in September	May - Oct - with major peaks in May and Aug	Oct, Mar, July, Aug, Dec and Feb	Jan-Oct - with a major peak in Feb-Mar	Jan-Aug - with a major peak in Feb-Mar	Jan-May - with a major peak in Jan-Feb
Main reproductive season	Spring	Spring	Autumn	Spring	Autumn/ Winter	All seasons	Summer/ Autumn	Summer/ Autumn	Summer
Presence of juveniles	All months except Jan	All months	Spring	All months except Mar, Apr and July	-	All seasons	Spring and Summer	Spring and Summer	Spring and Summer
Reference	Current study 2004 -2005	Current study 2006 -2007	Hailstone and Stephson 1961	Coleman 1981	Kenway 1981	McPhee and Skilleter 2002a	Rotherham and West 2007, 2009	Rotherham and West 2007, 2009	Rotherham and West 2007, 2009

* CL calculated using the linear equations described in Hailstone & Stephenson (1961): Male CL = 0.242 TL - 1.686; Female CL = 0.19 TL + 0.410.

Table 2. Comparison of the size of the smallest male and female, the largest male and female, the smallest ovigerous female, the mean embryo size (uneyed) (diameter and volume), the clutch size range, the reproductive period (by presence of ovigerous females), season at time of reproduction (main reproductive season) and the presence of juveniles for *Biffarius arenosus* collected in a number of studies throughout Australia. All size measurements are for carapace length (CL) in mm.

Locality	Western Port, Victoria	Western Port, Victoria	Western Port, Victoria
Smallest male collected (CL mm)	2-3	1-2	1-2
Smallest female collected (CL mm)	2-3	2-3	2-3
Largest male collected (CL mm)	6	8	8-9
Largest female collected (CL mm)	6	6	7-8
Smallest ovigerous female collected (CL mm)	3-4	3-4	4-5
Embryo volume (mm^3)	-	0.06-0.22	-
Embryo diameter (mm)	-	0.48-0.77	-
Mean embryo diameter (mm)	-	0.55	-
Clutch size (range)	-	31-216	-
Reproductive period	Sept - Feb	Sept - Feb, Mar - May	Aug - Nov, Nov - Mar
Main reproductive season	Spring	Spring/ Summer	Spring/ Summer
Presence of juveniles	Apr-June, Aug - Sept, Dec, Feb - Mar	All months	Mar- June, Sept - Oct
Reference	Current study 2004-2005	Current study 2006-2007	Coleman 1981

Discussion

There were general consistencies in the population structure and reproductive periods for *Trypaea australiensis* and *Biffarius arenosus* compared with previous studies. In particular, the current study showed very similar results to the study by Coleman (1981) from Western Port with the only main difference being slightly smaller *T. australiensis* males collected in the current study (Table 1). Similar sized individuals and the same reproductive period was found for *B. arenosus*. However, smaller ovigerous females of *B. arenosus* were found in the current study compared with Coleman (1981, Table 2). Hence, the smallest size limit of juveniles of *B. arenosus* can be revised to a carapace length of < 3 mm rather than a carapace length of < 4 mm as suggested by Coleman (1981).

Further differences in the biology of *T. australiensis* exist between the southern and northern Australian populations (see Table 1). In Moreton Bay, Queensland, the smallest male *T. australiensis* were 1–2 mm larger than the smallest male found in Western Port (Hailstone and Stephenson, 1961 compared to the current study). Also the largest male and female *T. australiensis* individuals were approximately 4 mm larger than the largest males and females found in the current study (Hailstone and Stephenson, 1961). In Cleveland Bay, North Queensland the smallest and largest males and females collected were also larger (approximately 4 mm) than those found in Western Port in the current study (Kenway, 1981). Size differences in ovigerous females of *T. australiensis* are also apparent with the smallest ovigerous females found in Moreton Bay (Hailstone and Stephenson, 1961) being larger (8 mm CL) than the ovigerous females found in Western Port (5-6 mm CL, Coleman 1981). In contrast, males and females collected from populations in south-eastern New South Wales were similar in size to those found in Western Port (Rotherham and West, 2009).

Latitudinal or site differences in sizes of individuals of the same species have been found for a number of different organisms throughout Australia. For example the carapace width of western rock lobster (*Panulirus cygnus*) females that carry two broods of embryos, has been found to decline progressively with decreasing latitudes (de Lestang and Melville-Smith, 2006), the size of individuals and growth rate of near-shore tropical squids *Loliolus noctiluca* was found to decrease from northern Queensland to southern New South Wales (Jackson and Moltschaniwskyj, 2001) and the mangroves *Avicenna marina*, are found to be up to 15 metres taller in northern areas of Australia than in Western Port, Victoria (Edgar, 2001). Reasons for the differences in sizes of individuals between latitudes include increases in growth rate due to warmer temperatures (Lonsdale and Levinton, 1985), latitudinal changes in food availability (Dumbald et al., 1996)

and limiting environmental properties such as temperature or salinity (Hanekom and Erasmus, 1988). For thalassinidean shrimps, Berkenbusch and Rowden (2000) found differences in the size of latitudinally different populations of the species *Callianassa filholi*. They found that there was no consistent trend in size differences from north to south with the mid-latitudinal populations growing to larger sizes than the other populations studied and it was suggested that food availability may have been the determining factor in the geographical differences in size of this species.

The size of the smallest ovigerous female did not vary substantially between northern and southern populations of *T. australiensis* (ranged from 5 - 8 mm, Table 1) however, the ovigerous females collected by McPhee and Skilleter (2002a) in Moreton Bay were much smaller (3 mm CL) than any reported elsewhere (Hailstone and Stephenson, 1961; Coleman, 1981; Kenway, 1981; Rotherham and West, 2009). Rotherham and West (2009) suggested that the small *T. australiensis* females reported in McPhee and Skilleter (2002a) were probably misidentified *B. arenosus*.

Another major difference between northern and southern Australian studies of *T. australiensis* occurs in the timing of the reproductive period (as shown by the presence of ovigerous females). In Moreton Bay and Cleveland Bay (Hailstone and Stephenson, 1961; Kenway, 1981; McPhee and Skilleter, 2002a), some of the reproductive period was in spring and summer but there was also a main peak in autumn and winter. In south-eastern New South Wales, reproductive period also peaked in summer with ovigerous females still present in the population in early Autumn (Rotherham and West, 2009). In contrast, the reproductive period in Western Port was restricted to spring and summer (Coleman, 1981, the current study 2004-2005 and 2006-2007). Hailstone and Stephenson (1961) found that greater than 90 percent of females were ovigerous in the main reproductive period (April) in Moreton Bay, which is similar to the proportions found by Coleman (1981) in Western Port, and Rotherham and West (2009) in south-eastern New South Wales. However, McPhee and Skilleter (2002a) found only 5.1% of females to be ovigerous, which is similar to the current study where 4% and 14% of *T. australiensis* females were found to be ovigerous in 2004-2005 and 2006-2007 respectively. This is an interesting finding as the most recent studies found less ovigerous females than studies conducted over 20 years earlier, perhaps a reflection of the large increase in collection of these species for bait in these areas during this period (McPhee and Skilleter, 2002b; Contessa and Bird, 2004). It has been suggested that large individuals are collected for bait in preference to smaller individuals (McPhee and Skilleter, 2002b) and this would include removing sexually mature or ovigerous females from the populations. Future studies may consider comparing the number of ovigerous females to see if this trend continues in areas of heavy bait collection.

More variability in the population structure of *T. australiensis* and *B. arenosus* was seen in the sex ratio of males to females. A variable sex ratio was found for *T. australiensis* while the sex ratio of *B. arenosus* was generally 1:1 or female biased. The sex ratio for *T. australiensis* was significantly female biased in August and September 2004-2005 and then significantly male biased in June and September 2006 and February and April 2007. Variability in sex ratio from male to female bias was also seen at Crib Point for *T. australiensis*. The sex ratio for *B. arenosus* was much less variable than for *T. australiensis* in the current study. Rarely, the ratio varied from 1:1 in 2004-2005 at Warneet and 2006-2007 at Crib Point. In 2006-2007 at Warneet there was a significant sex bias towards females. In the study by Coleman (1981), sex ratios were not statistically described but size frequency histograms for males and females of *T. australiensis* and *B. arenosus* seem to show an even number of males and females. This was variable in some months, consistent with the current findings.

For many species of thalassinidean shrimps (including previous findings of *T. australiensis*) a sex ratio of 1:1 [*Nihonotrypaea harmandi* (as *Callianassa japonica*); Tamaki et al., 1997, *Callianassa filholi*; Berkenbusch and Rowden, 1998] or a sex ratio biased towards females has been found (*T. australiensis;* Hailstone and Stephenson, 1961, *T. australiensis*; Kenway, 1981, *Lepidophthalmus* (as *Callianassa*) *louisianensis;* Felder and Lovett, 1989, *Callichirus major*; Botter-Carvalho et al., 2007; *T. australiensis*; Rotherham and West, 2009). There are a few exceptions where a male biased sex ratio occurs such as the study by Kevrekidis *et al.* (1997) that found *Upogebia pusilla*, to have a predominantly male sex bias in the Evros Delta, Aegean Sea. Rowden and Jones (1994) also found a male biased sex ratio for *Callianassa subterranea* in the North Sea. Although there are suggestions for sex bias in the literature, such as the loss of males through fighting, migration or predation (Felder and Lovett 1989; Dumbauld *et al.* 1996) or bias due to sampling gear efficiency (Rowden and Jones, 1994), it really is unclear how or why sex ratio bias occurs (Dworschak, 1998).

Interestingly in this study, there was a male biased sex ratio in the smaller individuals or juveniles (*T. australiensis* CL < 5 mm and *B. arenosus* CL < 3 mm) in 2004/ 2005 for *T. australiensis* and *B. arenosus* and in 2006/ 2007 at Crib Point for *T. australiensis* only. Rotherham and West (2009) also found a male biased sex ratio in the small size classes (< 6 mm CL) of populations of *T. australiensis* in south-eastern New South Wales. Other studies have reported a consistent male sex bias in smaller individuals of ghost shrimps even when there is a female sex bias in adults. For example, in Piedade Beach, north eastern Brazil, the sex ratio of *Callichirus major* was male biased in smaller individuals under 7 mm carapace length (Botter-Carvalho et al., 2007). Botter-Carvalho et al., (2007) suggested that although it is uncertain why a male biased sex ratio occurs in smaller individuals there may be some sampling biased imposed by using a bait pump to collect shrimps. Bait pumping has been suggested to selectively favour the collection of females as they occupy higher positions in the burrow more frequently (Rowden and Jones, 1994). Males are also faster and more vigorous in escaping the sampling technique of bait pumping (Botter-Carvalho et al., 2007). In the current study a male biased sex ratio in juveniles was found at Warneet for both *B. arenosus* and *T. australiensis* in 2004-2005 and not 2006-2007 at Warneet. This supports

the idea that bait pumping may preferentially collect females in the larger sizes as individuals collected in 2004-2005 were collected using a bait pump and in 2006-2007 they were removed through hand excavation of cores. Therefore, it is unclear if there are any ecological explanations of the variable sex ratio found in this study or if it is simply a product of the sampling efficiency.

In both 2004-2005 and 2006-2007, the population of *T. australiensis* comprised of two cohorts of individuals. This supports Hailstone and Stephenson's (1961) suggestion that this species lives for two years. There was however, no progression of these cohorts through time, again similar to findings of Hailstone and Stephenson (1961) and Coleman (1981) who suggested that a lack of progression in the mean size of cohort modes can imply a negligible growth rate or balanced recruitment and loss in the population. Individuals move into the population through larval recruitment (Dakin and Colefax, 1940; Hailstone and Stephenson, 1961) but it has also been suggested that individuals of *T. australiensis* could move between areas by burrowing or crawling on the surface of the substratum (Hailstone and Stephenson, 1961; Coleman, 1981) resulting in a highly dynamic population structure for this species.

For *B. arenosus*, generally only one cohort of individuals was seen each month in both 2004-2005 and 2006-2007. As with *T. australiensis* there was no progression of the mean carapace length of the cohorts of *B. arenosus* over time, prohibiting any estimation of growth. Coleman (1981) found similar results for *B. arenosus* in Western Port in 1981. No progression in the mean carapace lengths through time may suggest that as with *T. australiensis* the population is highly dynamic with constant recruitment and/ or migration into the population. Alternatively, with only one cohort present each month this species may only live for one year. No data is available on the development of *B. arenosus*, either larval stages or growth parameters therefore further study is needed so that inferences can be made about the age and life cycle of this species.

The fecundity of each species was shown through measurements of clutch and embryo size. The clutch size was positively correlated with the size of females for both species, which is consistent with many other studies of thalassinidean shrimps (e.g. Dworschak, 1988; Berkenbusch and Rowden, 2000; Kubo et al., 2006; Rotherham and West, 2009). *Trypaea australiensis* had significantly larger embryos and a significantly larger clutch size than *B. arenosus*, a result which is not surprising since *T. australiensis* females are much larger than *B. arenosus* females.

Rotherham and West (2009) found that *T. australiensis* had on average smaller embryos in the Moruya River, New South Wales than the mean embryo sizes found in the current study for *T. australiensis* in Western Port. This pattern of smaller embryo size occurring at higher latitudes (New South Wales compared with Victoria) is consistent with Berkenbusch and Rowden (2000) who found that the embryo size of *Callianassa filholi* increased significantly with higher latitudes. The sites sampled by Berkenbusch and Rowden (2000) that showed differences in embryo sizes were separated by greater than 5° in latitude which is similar to the degree of separation between the sites sampled by Rotherham and West (2009) and the sites sampled in the current study. Kubo et al. (2006) also found a latitudinal gradient in the size of ghost shrimps (*Nihonotrypaea japonica* and *N. harmandi*) embryos, again with the smaller embryos at higher latitude. Berkenbusch and Rowden (2000) summarised literature that showed that food availability may be a driving factor of latitudinal differences in embryo size. In contrast, Kubo et al. (2006) attributed latitudinal differences in embryo size to differences in temperature. For example, the higher the latitude the cooler the water and therefore the larger the embryo size [as seen for *N. japonica* (cooler waters) and *N. harmandi* (warmer waters)] (Kubo et al., 2006). Further evidence for temperature being the primary factor is shown by Kubo et al. (2006) for *N. japonica* in Ariake Sound, where embryos produced in winter to spring were larger than embryos produced in summer. In Australia, it is unknown whether it is temperature, food availability or some other factor that leads to a latitudinal difference in the embryo size of *T. australiensis* however as Rotherham and West (2009) describe, there is a known temperature gradient from north (lower latitudes) to south (higher latitudes) along the east coast of Australia suggesting that temperature may be the primary factor for latitudinal differences in Australia.

The clutch size of *T. australiensis* was also reported by Rotherham and West (2009). The range of clutch sizes for *T. australiensis* in the current study is at the lower end of this range found in Rotherham and West (2009). This may be due to a 'trade-off' in the need for *T. australiensis* to produce larger embryos in cooler waters in Victoria and therefore less embryos and a smaller clutch size. This was suggested as a possible reproductive trait of *N. japonica* by Kubo et al. (2006) where the embryos produced in winter were larger and the clutch size was reduced due to the need to produce embryos with higher nutrients to withstand 'nutritional stress' brought about by winter conditions (Paschke et al., 2004).

Kubo et al. (2006) compared the population biology, particularly fecundity, of many thalassinidean shrimp species from around the world. From these comparisons it was shown that shrimps with similar embryo and clutch sizes had very similar life history traits. For example, *Nihonotrypaea harmandi* and *N. petalura* have similar embryo volumes to *Callianassa filholi, C. subterranean* and *Neotrypaea californiensis* all of which have four or five zoeal stages and relatively long planktonic periods (>15 days). Seven other species in this comparison (*Callichirus* (as *Callianassa*) *kraussi, Neocallichirus* (as *Callianassa*) *kewalramanii, Callichirus major, Lepidophthalmus louisianensis, L. sinuensis, Pestarella tyrrhena,* and *Sergio mirim*) had larger embryos and had only two to three planktotrophic/ lecithotrophic zoeal stages with shorter planktonic periods (<14 days). This comparative information is useful in predicting the type of life history pattern that a particular species might have. There have been a number of studies on the life history of *Trypaea australiensis* that show the number of zoeal stages and planktonic period for this species. However for *Biffarius arenosus,* there is very little information. The mean embryo

volume of *Biffarius arenosus* found in the current study falls into the group of species reported by Kubo et al. (2006) that have smaller embryos (<0.180 mm^3) and therefore it is predicted that *B. arenosus* would have around 4-5 zoeal stages and a relatively longer planktonic period. The embryos of *Trypaea australiensis* fall into the group of species reported by Kubo et al. (2006) that have larger embryos (embryo volume > 0.180 mm^3) and this suggests that the life cycle of *T. australiensis* would have two to three zoeal stages. Unfortunately, these predictions need to be taken with some caution as previous studies of the life history of *T. australiensis* have showed that *T. australiensis* has six larval planktonic stages with a relatively long period of larval development (up to 6 weeks) (Dakin and Colefax, 1940; Hailstone and Stephenson, 1961), a result which is not consistent with the evidence presented by Kubo et al. (2006). Therefore, although this summary by Kubo et al. (2006) is useful in making some predictions about the life history of these species (particularly *B. arenosus*) further laboratory studies are required to definitively observe the life cycle of these species.

Conclusions

This study has provided information about the population structure of *T. australiensis* and *B. arenosus* that confirms previous findings about these species in Western Port (Coleman, 1981), but shows some key differences between Western Port populations and northern and eastern Australian populations (Hailstone and Stephenson, 1961; Kenway, 1981; McPhee and Skilleter, 2002a; Rotherdam and West, 2007; Rotherham and West, 2009). It also provides new information on the fecundity of both species, in particular *B. arenosus*. The main differences between findings from this study and others occurred in the time of breeding seasons and small variations in the timing of recruitment of juveniles into the populations. There was also significant evidence that there are latitudinal differences in the size of individuals and the fecundity of *T. australiensis* along the east coast of Australia. These findings are consistent with other latitudinal studies of ghost shrimp biology around the world (e.g. Berkenbusch and Rowden, 2000; Kubo et al., 2006) and suggest that further environmental data should be collected alongside population data so that factors contributing to these latitudinal differences can be determined. Furthermore, given that there are some differences in the population dynamics of the same species of ghost shrimps at different latitudes, any studies investigating ghost shrimps for use as indicators of benthic habitats need to take into account local differences in population biology.

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Iphimedia poorei, a new species of Iphimediidae (Crustacea, Amphipoda) from the New South Wales Australian coast

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Abstract Coleman, C.O. and Lowry, J.K. 2009. *Iphimedia poorei*, a new species of Iphimediidae (Crustacea, Amphipoda) from the New South Wales Australian coast. *Memoirs of Museum Victoria* 66: 61–69.

The new species *Iphimedia poorei* is described and illustrated in detail. It differs very much from all known species of the genus by its numerous, extravagant dorsal processes, stout spines on all coxal plates, cuspidate basis and the drawn out, pointed merus on each of pereopods 5–7.

Keywords Crustacea, Amphipoda, Iphimediidae, taxonomy, new species, Australia

Introduction

Recently the number of taxa of Iphimediidae recognized has been significantly increased, especially due to descriptions of new species of *Iphimedia* from the Indo-West Pacific and the coasts of Australia (Coleman and Lowry, 2006). Lowry and Myers (2003) described six species of *Iphimedia* from New Caledonia, Papua New Guinea and Thailand. Coleman and Lowry (2006) reviewed the Australian iphimediid fauna and described six additional species, based on collections from around the entire coastline. This brought the total number of known Australian species to ten. It was therefore unexpected when a new and highly conspicuous species of Iphimediidae was recently collected on the rather well sampled coast of New South Wales. This species is described herein.

Material was fixed in 70% ethanol. Pencil drawings were made with a camera lucida on a Leica Wild M5 dissecting microscope and a Olympus BX50 compound microscope. The line drawings were made using the technique described in Coleman (2003). Length measurements were made along the dorsal outline of the animals, beginning at the tip of the rostrum to the end of the urosome. The material is deposited in the Australian Museum, Sydney.

Iphimediidae Boeck, 1871

Iphimedia Rathke, 1843

Iphimedia poorei sp. nov.

Figures 1–7

Type material. Holotype, female, 5.2 mm, AM P74747, north side of Burrewarra Point, south of Batemans Bay, New South Wales, Australia (35°49'53"S 150°14'6"E), Australian Museum Party, 27 March 2004 (NSW 2606).

Type locality. Burrewarra Point, south of Batemans Bay, New South Wales, Australia (35°49'53"S 150°14'6"E).

Etymology. The species is named for Dr. Gary C. B. Poore to thank him for his great contributions to the knowledge of crustaceans.

Diagnosis. Pereonites and pleonites covered with dorsal, dorsolateral and lateral spines. Maxilla 1 palp much shorter than outer plate. Maxilliped palp 3-articulate, article 2 distomedially strongly expanded into rounded lobe, guarding along article 3 and almost reaching its apex. Pereopods 1–7 coxae with spines on lateral faces. Pereopods 5–7 each with spiny basis and considerably drawn out and pointed merus.

Description. Based on holotype, female, 5.2 mm.

Head. Head with rather straight rostrum, with dorsal elevated ridge; eyes round, bulging; anterior head margin angularly pointed; ventral margin rounded. *Antenna 1* with massive peduncle article 1, expanded distally into 2 anteromedially directed spines; peduncle article 2 with short lateral and very long medial distal spine, the latter surpassing article 3; accessory flagellum vestigial, only consisting of short scale; flagellum short, consisting of 9 articles. *Antenna 2* peduncle article 1 scale-like with additional rounded lobe; article 2 with truncate gland cone; article 3 expanded distally and drawn out into a spine laterally; article 4 subequal to 5, distally expanded and acutely drawn out laterally; article 5 subrectangular; flagellum consisting of 10 articles. Mouthparts bundled into a tapering cone. *Labrum (upper lip)* longer than wide, tapering with rounded apex. *Mandibles* long, slender,

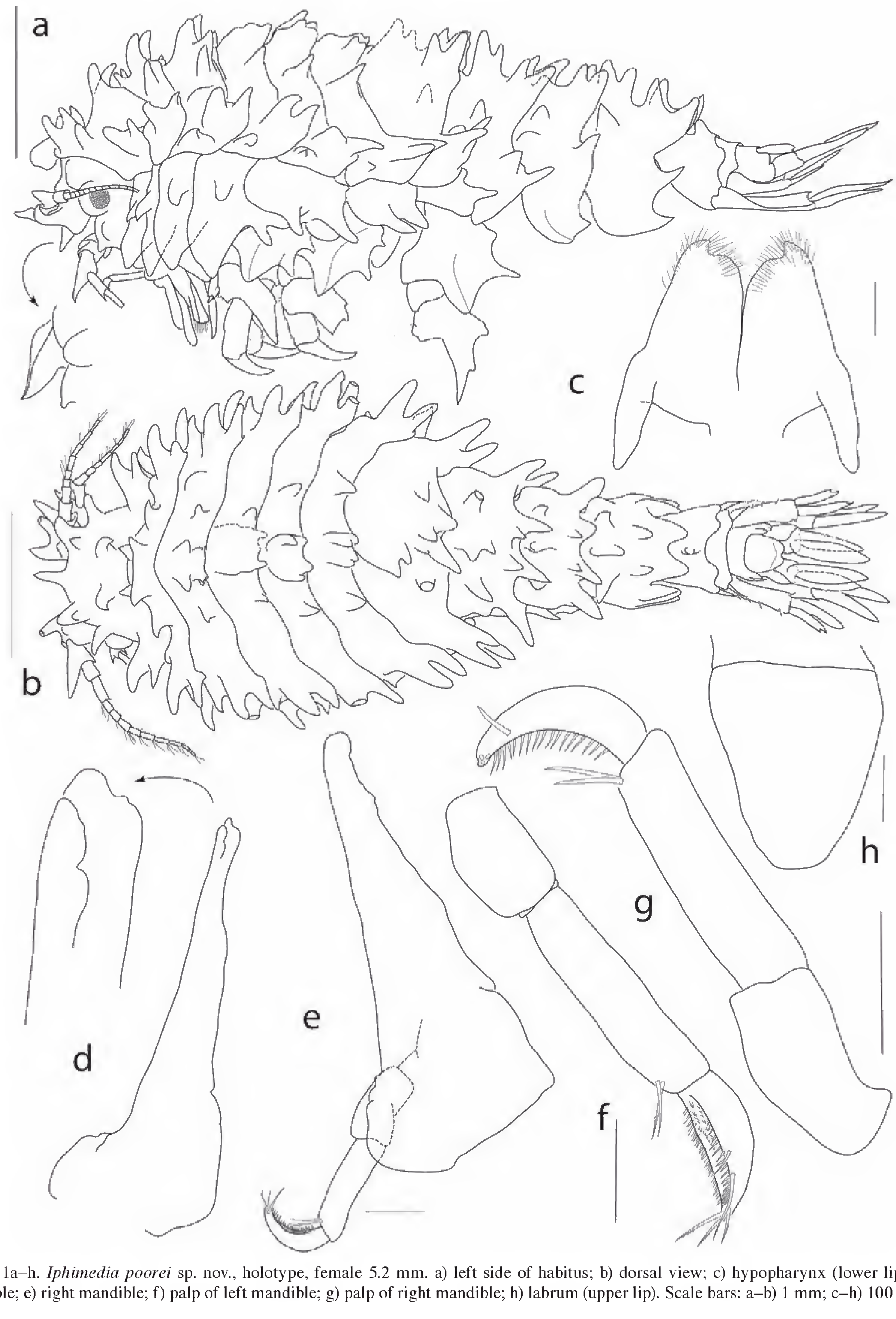

Figure 1a–h. *Iphimedia poorei* sp. nov., holotype, female 5.2 mm. a) left side of habitus; b) dorsal view; c) hypopharynx (lower lip); d) left mandible; e) right mandible; f) palp of left mandible; g) palp of right mandible; h) labrum (upper lip). Scale bars: a–b) 1 mm; c–h) 100 μm.

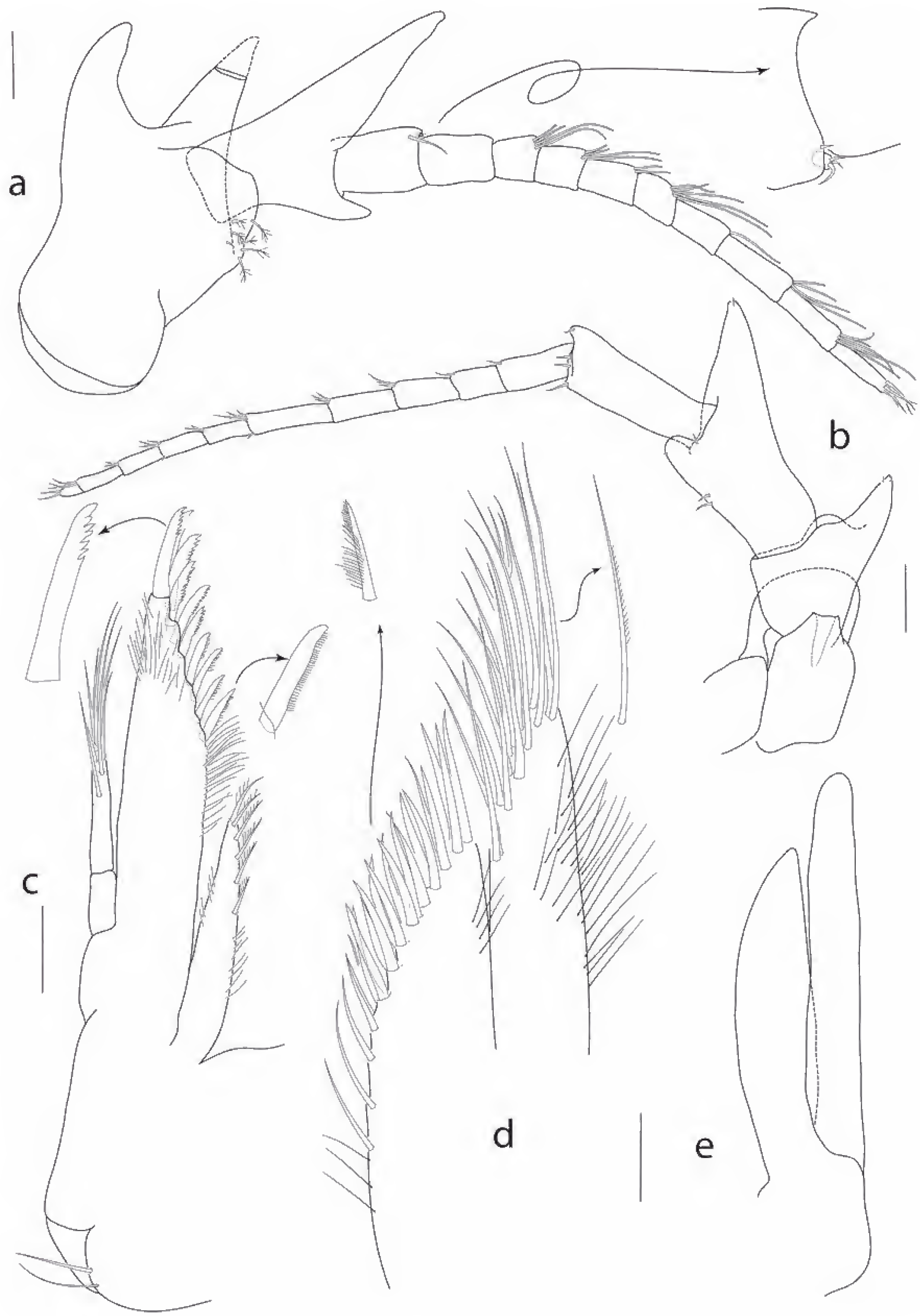

Figure 2a–e. *Iphimedia poorei* sp. nov., holotype, female 5.2 mm. a) antenna 1; b) antenna 2; c) maxilla 1; d) apex of maxilla 2; e) outline of maxilla 2. Scale bars: a–e) 100 μm.

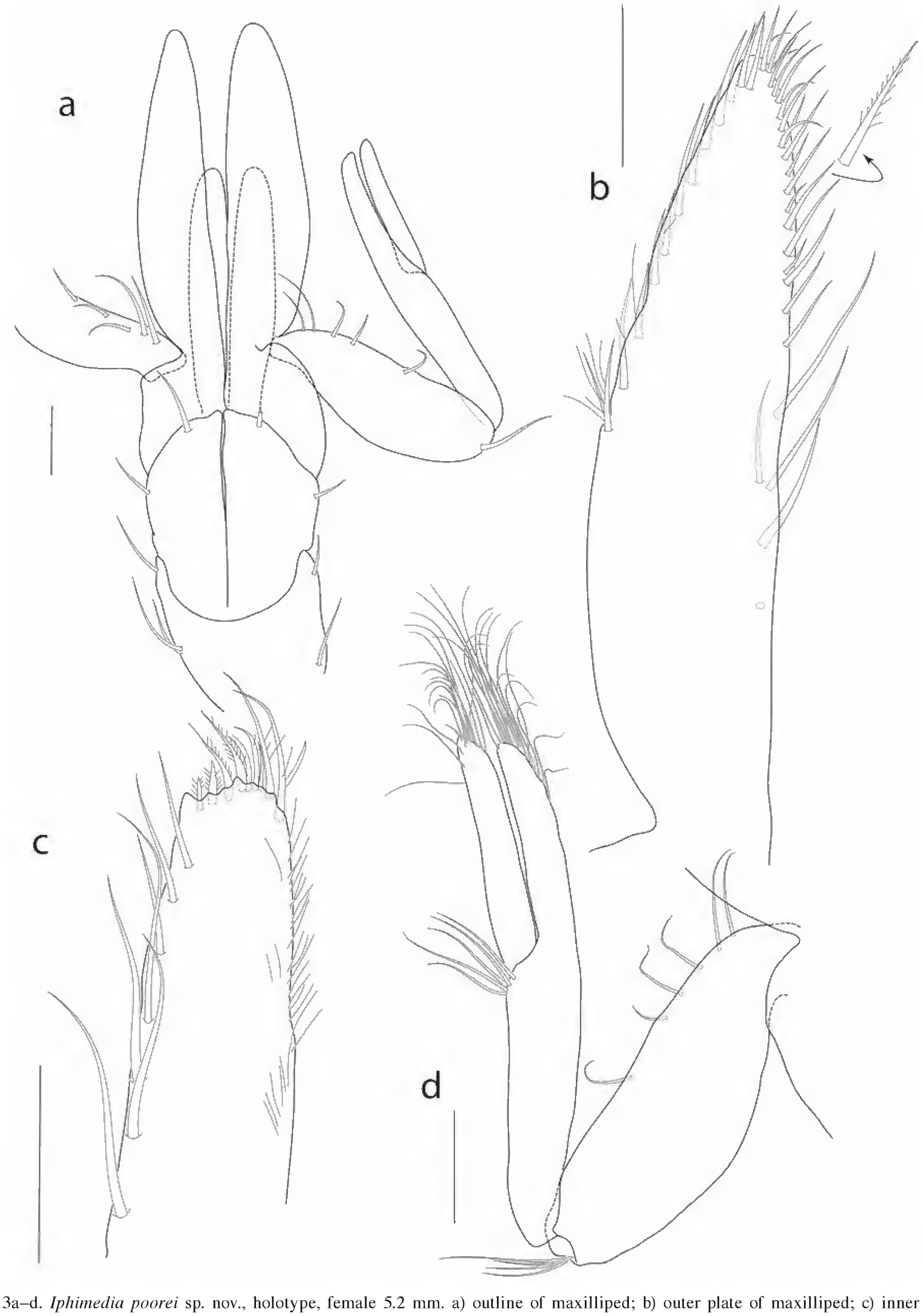

Figure 3a–d. *Iphimedia poorei* sp. nov., holotype, female 5.2 mm. a) outline of maxilliped; b) outer plate of maxilliped; c) inner plate of maxilliped; d) palp of maxilliped. Scale bars: a–d) 100μm.

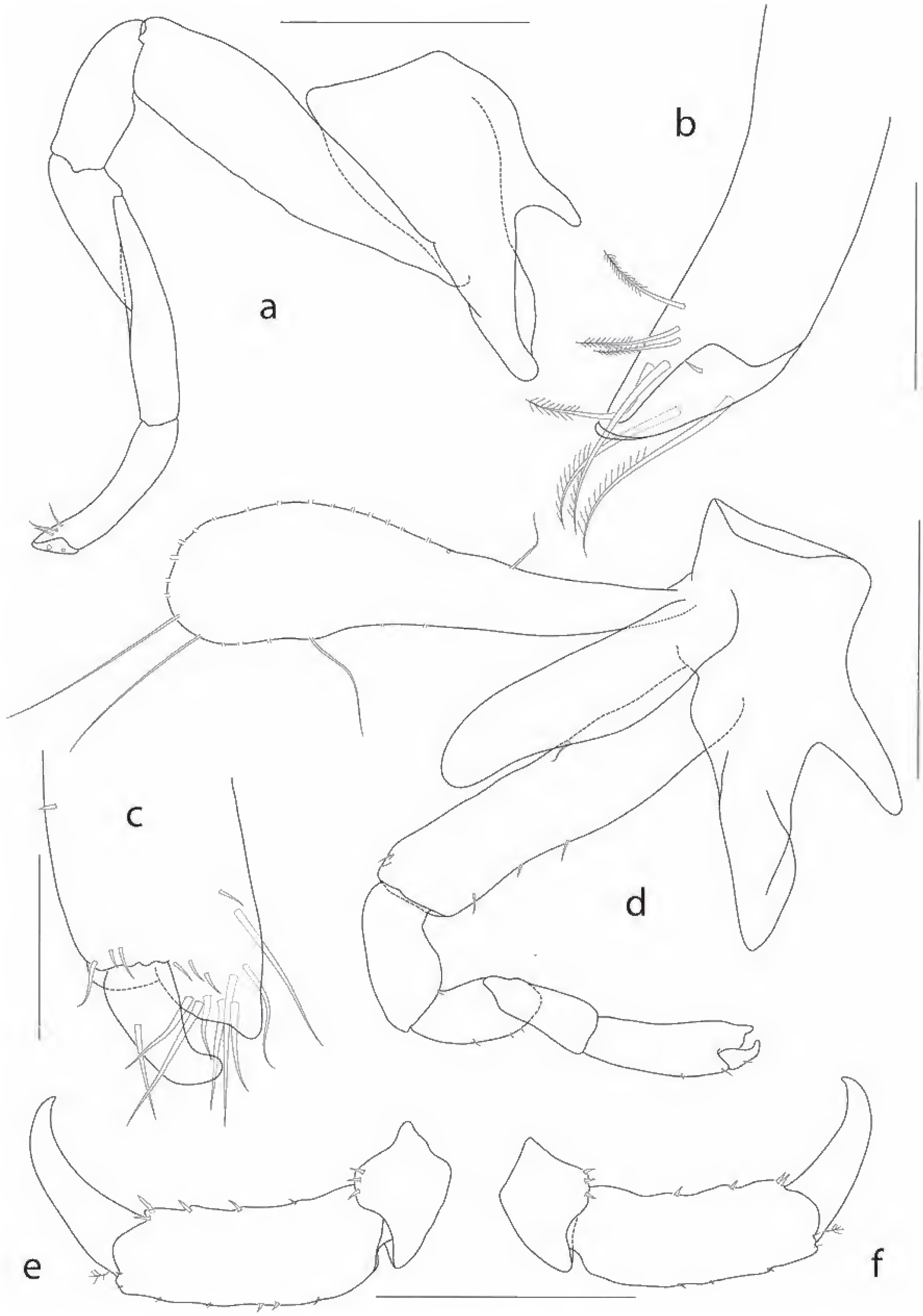

Figure 4a–f. *Iphimedia poorei* sp. nov., holotype, female 5.2 mm. a) gnathopod 1; b) chela of gnathopod 1; c) chela of gnathopod 2; d) gnathopod 2 (seta on chela omitted); e–f) broken off carpus to dactylus of pereopods. Scale bars: a, d, e–f) 500 μm; b–c) 100 μm.

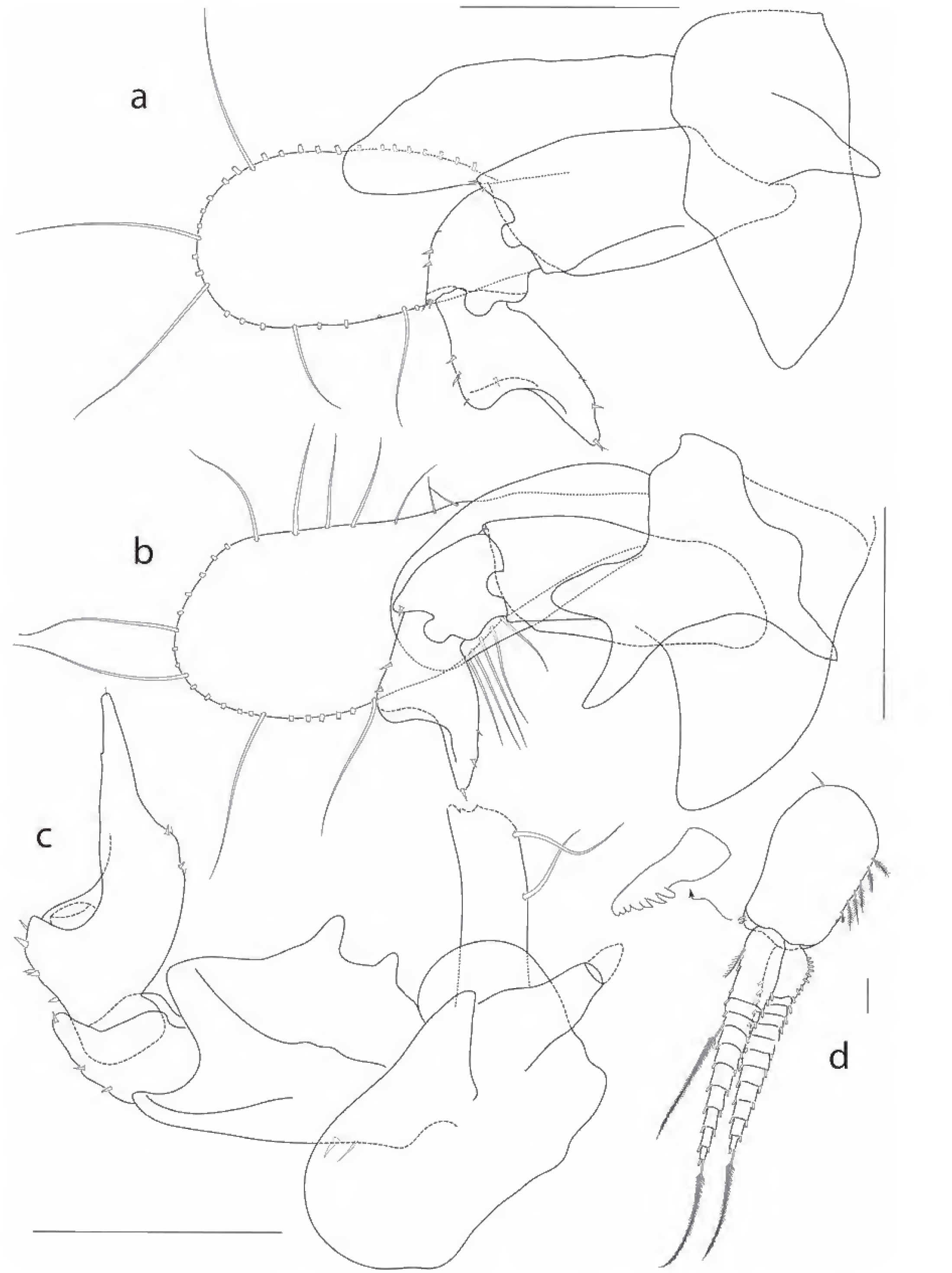

Figure 5a–d. *Iphimedia poorei* sp. nov., holotype, female 5.2 mm. a) pereopod 3; b) pereopod 4; c) pereopod 5; d) pleopod 1. Scale bars: a–c) 500 μm; d) 100 μm.

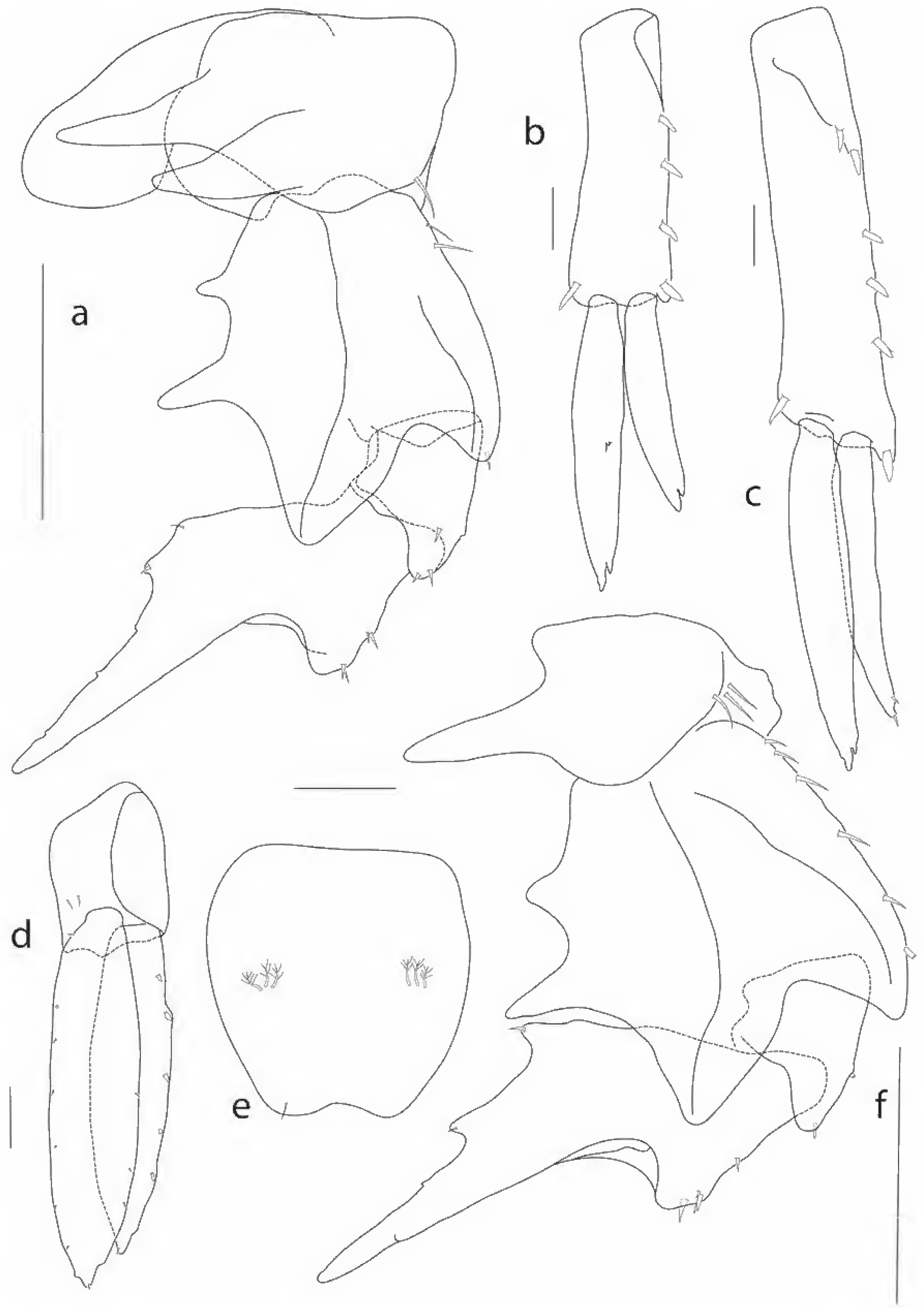

Figure 6a–f. *Iphimedia poorei* sp. nov., holotype, female 5.2 mm. a) pereopod 6; b) uropod 2; c) uropod 1; d) uropod 3; e) telson; f) pereopod 7. Scale bars: a, f) 500 μm; b–e) 100 μm.

Figure 7. *Iphimedia poorei* sp. nov., holotype, female 5.2 mm. Photography of the habitus

with narrow apex; molar and spine row wanting; palp 3–articulate; left mandible with inconspicuous lacinia mobilis. *Hypopharynx (lower lip)* with medially notched lobes, hypopharyngeal processes narrow. *Maxilla 1* inner plate narrow, pointed, with 5 mediomarginal setae; outer plate distally oblique with 10 serrate setal-teeth; palp 2–articulate, much shorter than outer plate. *Maxilla 2* outer lobe narrower and longer than inner plate, with long setae; inner plate with shorter and stouter setae. *Maxilliped* slender; inner plate apically truncate with stout and several long and slender setae, long slender setae on medial margin; outer plate slender and tapering distally into subacute apex; palp article 1 long, expanded posteriorly; article 2 half the width of article 1, distomedially strongly expanded into rounded lobe, guarding along article 3 and almost reaching its apex; article 3 about half the width of article 2; apices of articles 2 and 3 with a dense tuft of slender setae.

Pereon. Pereonite 1 with a rounded anteriorly directed lobe on the front margin; on both sides 2 spines anterolaterally, 1 dorsolateral spine, 2 posterolateral spines and a pair of mid-dorsal spines at the posterior segmental border. *Pereonite 2* shortest, on both sides with 2 lateral spines, 1 dorsolateral spine and a pair of mid-dorsal spines, accompanied by a pair of small spines anteriorly. *Pereonite 3* on both sides with 2 lateral spines plus 1 small spine ventrally of those, 1 dorsolateral spine and a pair of mid-dorsal accompanied by a pair of shorter spines posteriorly. *Pereonites 4–6* on both sides with 2 lateral spines plus 1 small spine ventrally of those, and an arrangement of 2 pairs of bilobed wide carinate spines. *Pereonite 7* on both sides with 2 lateral spines plus 1 small ventral spine, a dorsolateral spine and anteriorly with a bilobed mid-dorsal carina followed by 2 pairs of spines posteriorly. *Gnathopod 1* coxa strongly tapering, apically pointed, anterior margin with slender prominent spine; basis long expanded distally; ischium and merus subequal in length; carpus 1.3 x propodus; propodus slightly curved, forming a chela with dactylus. *Gnathopod 2* coxa strongly tapering, apically pointed, anterior margin with slender prominent spine, longer and stronger than that of coxa 1; basis subrectangular; ischium and merus subequal, shorter and those of gnathopod 1; merus and carpus subequal; propodus 1.3 x carpus length, setose apically only, forming a stouter chela compared to gnathopod 1. *Pereopod 3* with wider coxa compared to gnathopods, with spine on lateral face; basis wide, rounded narrow lobe distally; ischium short, wide, slightly curved anteriorly, rounded narrow lobe distally; merus anterodistally acutely drawn out; carpus to dactylus broken off. *Pereopod 4* with 2 spines on lateral face and a subacute lobe posteromarginally; basis to merus as for pereopod 3; carpus to dactylus broken off. *Pereopod 5* coxa wider than long, rounded anteriorly, with a rounded slightly ventrally expanded lobe, 2 stout spines on lateral face directed posteriorly; basis wide, 2 spines posteromarginally, ventral

spine longer, posteroventrally lobate, anteroventrally produced; ischium produced anterodistally; merus, widened distally, acutely drawn out posterodistally; carpus to dactylus broken off. *Pereopod 6* coxa slightly wider than long, anteriorly straight, small posterior lobe, 2 strong spines on lateral face; basis similar to that of pereopod 5 but larger and posteroventral lobe pronounced; ischium as for pereopod 5; merus dramatically drawn out posterodistally, posterior margin with 1 protrusion; carpus to dactylus broken off. *Pereopod 7* coxa smallest with one stout spine posteriorly; basis similar to that of pereopod 6, but wider; ischium as for pereopod 6; merus similar in shape to that of pereopod 6 but longer and wider and with 2 posteromarginal subacute protrusions.

Pleon. *Pleonite 1* with a similar mid-dorsal and dorsolateral arrangement as pereonite 7; epimeron with a long narrow pointed posterolateral process and an additional spine, ventral margin narrowly rounded. *Pleonite 2* with a small rounded anterior protrusion and a posterior pair of double spines mid-dorsally, 1 dorsolateral spine on both sides; epimeron with a posterolateral spine, posteroventral corner with pointed spine. *Pleonite 3* with a large bilobed carina and a posterior pair of double spines mid-dorsally, 1 dorsolateral spine on both sides; epimeron with a posterolateral slightly upward curved spine and an equally long pointed spine at the posteroventral angle.

Pleopods normal, inner ramus slightly longer than outer.

Urosome. *Urosomite 1* with short narrow rounded mid-dorsal process somewhat directing anteriorly. *Urosomite 2* shortest. *Uropod 1* peduncle longer than rami; outer ramus slightly shorter than inner; both rami without marginal spines (except for minute apical ones on outer ramus). *Uropod 2* peduncle subequal in length to inner ramus; outer ramus shorter than inner, both rami without marginal spines. Uropod 3 peduncle short; rami lanceolate; outer ramus shorter than inner, with marginal spines on outer margin; inner ramus with only minute spines. *Telson* about as long as wide, emarginate.

Remarks. This species has a very special habitus that differs from all other Australian iphimediids and is superficially similar to some species in the Antarctic genus *Echiniphimedia* K.H. Barnard, 1930. Similar to this genus *Iphimedia poorei* sp. nov. has several rows of spines on the dorsal side of its pereon and pleon, as well as on the face of the coxae, mid-dorsal carinae on some segments and a typical arrangement of paired dorsal processes (sometimes combined with a mid-dorsal carina) on the posterior pereon and the pleon that most iphimediids have.

However, the new species is not classified as *Echiniphimedia* because of the following characters. In *I. poorei* the antenna 2 peduncular articles 3 and 4 are each drawn out into an apical spine (vs spine-less); the mandibular incisors are narrow (vs wider, dentate incisors); there are medioapical notches on the hypopharyngeal lobes (vs unnotched); the palp of the maxilla 1 is much shorter than the outer plate (vs subequal or longer); the palp of the maxilliped is 3–articulate with article 2 medioapically strongly produced along article 3 (vs basic, 4–articulate without any article medially produced); gnathopod 2 is weakly setose only on the chela (vs dense setation along posterior margin of carpus and propodus); the merus on pereopods 5–7 dramatically drawn out posterodistally (vs only weakly drawn out).

A closer look shows that the new species is very similar in several aspects to some species of *Iphimedia*. However, none of these species of *Iphimedia* exhibits such an extraordinary dorsal spination, spines on the face of the coxal plates and extremely drawn out posterodistal angles of the merus on each of the posterior pereopods as the new species. Traditionally, taxonomists would have classified this species as a new genus, due to its remarkable differences to all known species of Iphimediidae. We, however, see this species embedded inside the genus *Iphimedia*. It has morphological affinities to *Iphimedia macrocystidis* (K.H. Barnard, 1932), *Iphimedia magellanica* Watling and Holman, 1980 and *Iphimedia multidentata* (Schellenberg, 1931), all species known only from the Antarctic. They have the same arrangement of the maxilliped palp article 2 projecting along article 3, a maxilla 1 palp which is shorter than the outer plate and an multicuspidate basis of pereopod 7. A combination of some of these character combinations can also be found within the Australian iphimediids: *Iphimedia beesleyae* Coleman and Lowry, 2006, *Iphimedia oetkeri* Coleman and Lowry, 2006 and *Iphimedia filmersankeyi* Coleman and Lowry, 2006 have very similar mouthparts to the new species. *Iphimedia filmersankeyi* is the most similar species to *I. poorei*. The mandible, maxilla 1 and maxilliped only differ in very small details; pereopods 5–7 each have a spiny basis with the merus considerably drawn out and pointed.

Acknowledgments

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Paralamprops poorei, sp. nov. (Crustacea: Cumacea: Lampropidae), a new Australian cumacean.

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Abstract Gerken, S. 2009. *Paralamprops poorei*, sp. nov. (Crustacea: Cumacea: Lampropidae), a new Australian cumacean. *Memoirs of Museum Victoria* 66: 71–75.

Paralamprops is a small genus in the cumacean family Lampropidae. A new species, *Paralamprops poorei* sp. nov. is described from the southern Australian continental slope. *Paralamprops poorei* can be distinguished from all other *Paralamprops* by the combination of a toothed marginal carina, subequal antennular flagellae, maxillule without palp, pereopods 3 and 4 in the female with rudimentary exopods, pereopod 5 with article proportions as in pereopods 3 and 4, telson with 5 lateral setae and 3 equal terminal setae, and the male with three pairs of pleopods.

Keywords Lampropidae, Cumacea, Paralamprops, Crustacea

Introduction

The genus *Paralamprops* Sars, 1887 currently contains 19 species, with species ascribed to the genus from around the world, with records from 232–5395 m. The difficulties of collecting intact deep sea crustaceans are well known, and *Paralamprops* is particularly difficult to collect in an undamaged state, as the pereopods are generally quite long and delicate and prone to damage. Of the 19 species in the genus, 8 were erected on the basis of single specimens, although *P. semiornatus* Fage, 1929 has been redescribed from ample material by Roccatagliata (1994). Due to the incomplete descriptions of some species ascribed to *Paralamprops*, the generic diagnosis is quite variable, including presence and absence of a maxillule palp, and it is likely that the genus is not monophyletic.

Methods

Samples were collected with a WHOI epibenthic sled, fixed in formalin on board the RV Franklin and transferred to 70% ethanol at the Museum Victoria, Melbourne, Australia (NMV). All material examined belongs to the collection of the Museum Victoria. Specimens were temporarily mounted in a mixture of 10% ethanol/ 90% glycerin and drawn with a Leica MZ16 dissecting microscope with *camera lucida* or a Leica DM LS2 compound microscope with *camera lucida*. Body length is measured from the tip of the pseudorostrum to the posterior border of pleonite 6. Figures were prepared in Adobe Illustrator after the instructions in Coleman, 2003.

Lampropidae

Paralamprops Sars, 1887

Paralamprops poorei sp. nov.

Figures 1–2

Material examined. Holotype. Australia, Victoria, 76 km S of Point Hicks (38 29 20 S – 38 26 49 S, 149 19 59 E – 149 20 47 E), 1840 m, 26/10/1988, col. Poore, Gary CB, NMV J59990 (ovigerous female).

Paratypes. Australia, Victoria, 76 km S of Point Hicks (38 29 20 S – 38 26 49 S, 149 19 59 E – 149 20 47 E), 1840 m, 26/10/1988, col. Poore, Gary CB, NMV J59992 (subadult female); J59991 (subadult female dissected); J54394 (5 subadult males, 2 subadult females).

Diagnosis. Carapace with strongly toothed marginal carina, with dorsolateral swellings, otherwise without setae or spines. Antennule main flagellum and accessory flagellum subequal in length. Maxillule without palp. Pereopods 3 and 4 in the female with rudimentary exopods. Pereopod 5 shorter than basis of pereopod 4, of 6 articles, article proportions similar to pereopods 3 and 4. Male with 3 pairs of pleopods. Telson with 5 lateral setae, 3 equal terminal setae. Uropod exopod shorter than endopod.

Description. Holotype ovigerous female, body length 12 mm. Carapace surface smooth, with paired dorsolateral swellings, dorsoventrally flattened, marginal carina with distinct large teeth throughout, antennal notch absent; eyelobe less than 0.1 carapace length, no lenses present; carapace longer than thoracic segments together (fig. 1A).

Paratype subadult female (fig. 1B).

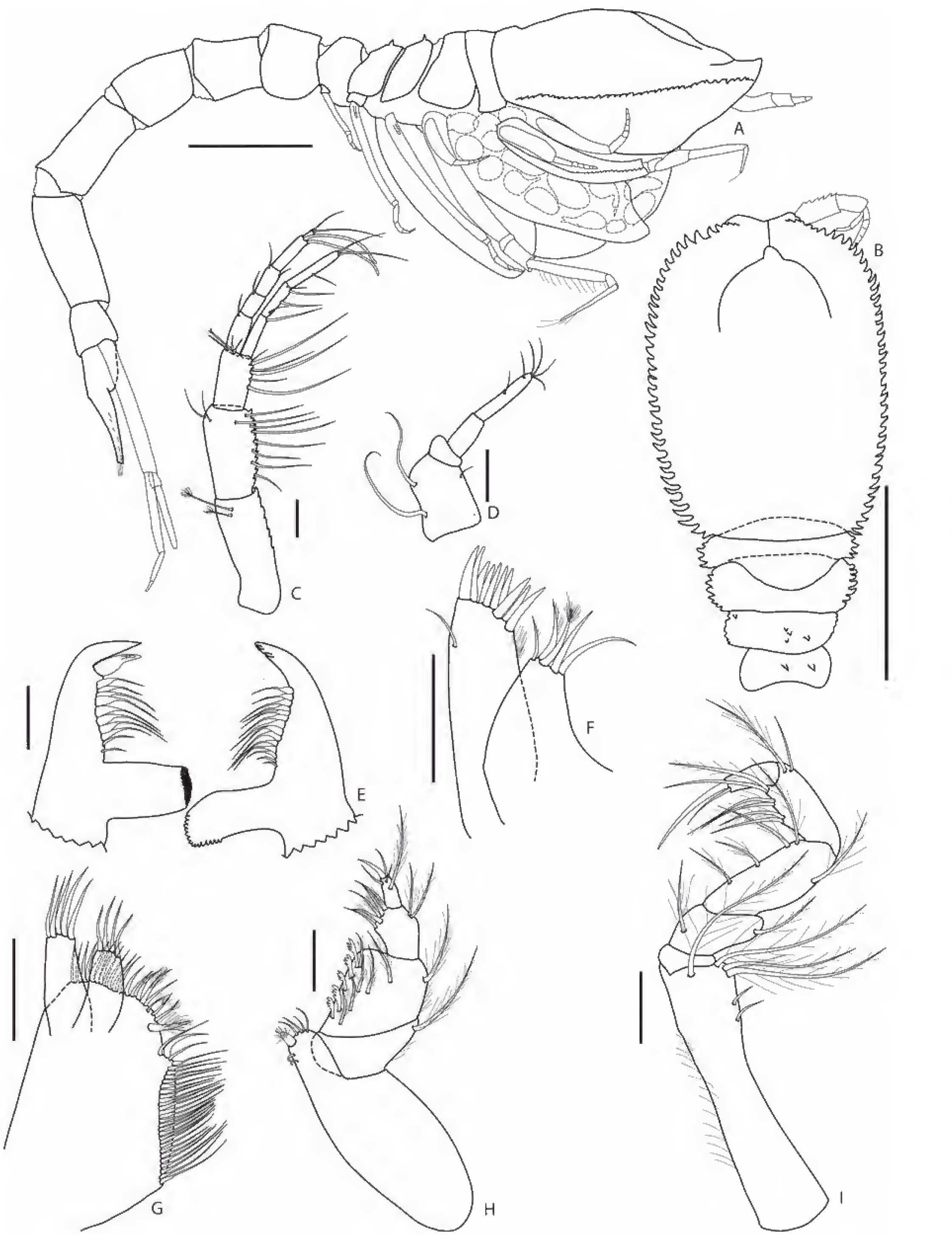

Figure 1. *Paralamprops poorei* sp. nov., female: a, side view, holotype ovigerous female J5990; b, dorsal view subadult female, paratype J59992; c-i, subadult female, paratype J59991; c, antennule; d, antenna; e, mandibles, broken; f, maxillule; g, maxilla; h, maxilliped 1; i, maxilliped 2. Scale bars for side and dorsal view 1.0 mm, all other scale bars 0.1 mm.

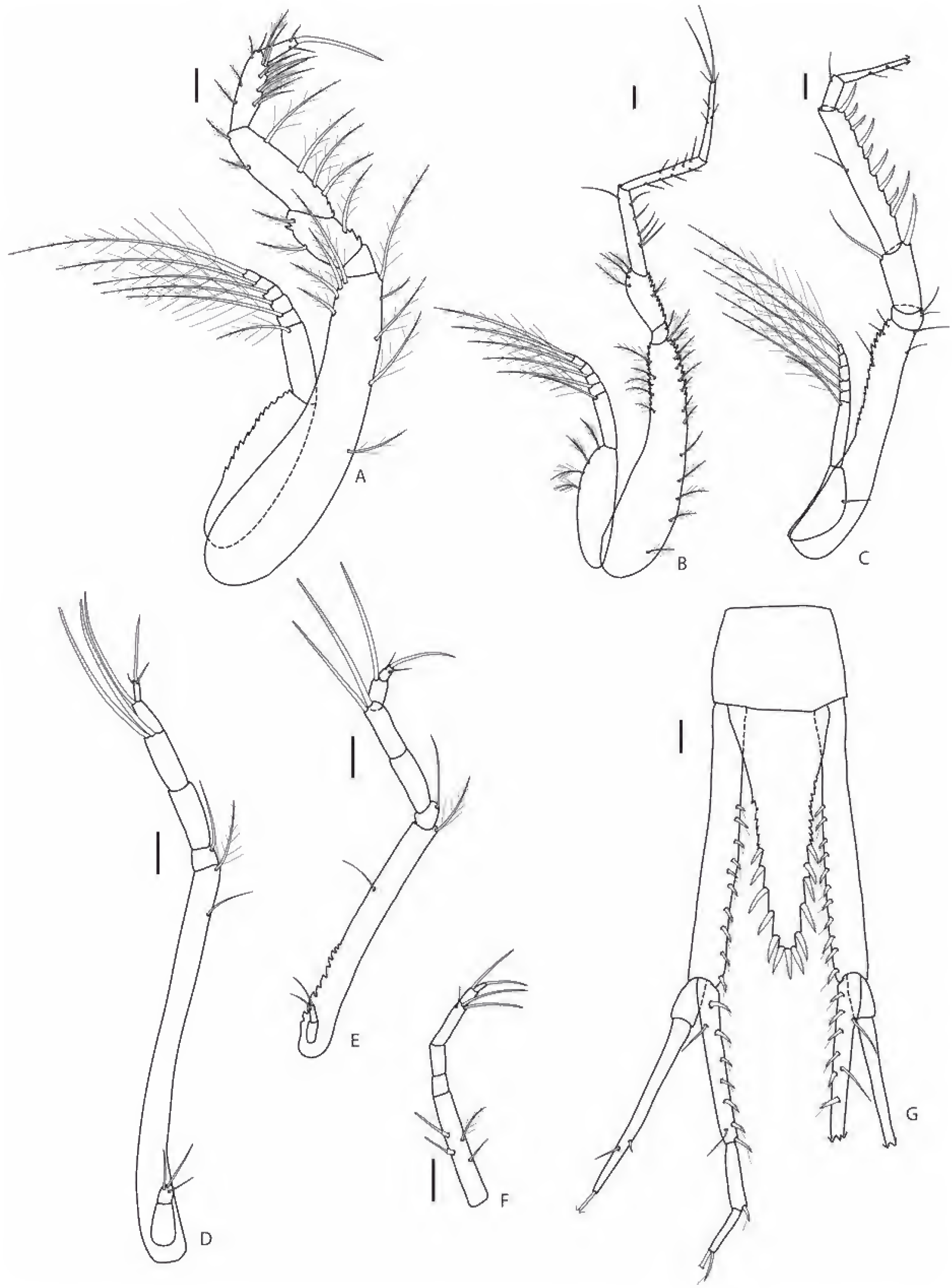

Figure 2. *Paralamprops poorei* sp. nov., subadult female, paratype J59992: a, maxilliped 3; b, pereopod 1; c, pereopod 2; d, pereopod 3; e, pereopod 4;f, pereopod 5; g, telson and uropods. All scale bars 0.1 mm.

Antennule extending past pseudorostral lobes; peduncle article 1 longest, with 2 complex pedunculate setae; article 2 0.8 length of article 1, with simple setae, margin serrate; article 3 0.6 length of article 2, with 6 simple and 4 complex pedunculate setae; main flagellum of 5 articles, each article with 1 simple seta, subterminal article with 2 aesthetascs; accessory flagellum of 3 articles, subequal to main flagellum, with simple setae (fig. 1C)

Antenna of 4 articles; article 1 with 2 simple setae; article 2 shortest, unarmed; article 3 unarmed; article 4 with 6 small simple setae (fig. 1D).

Mandibles navicular (broken in fig.), with row of 10–13 setae, left mandible with lacinia mobilis (fig. 1E).

Maxillule of 2 endites; outer endite with row of stout setae distally; inner endite with 2 simple and 3 microserrate setae distally; palp absent (fig. 1F).

Maxilla of 3 endites; broad endite distal margin with simple and pappose setae, medial margin with row of setae; medial narrow endite with 4 microserrate setae; lateral narrow endite with 5 simple setae; both narrow endites extend past setae on distal margin.

Maxilliped 1 basis produced distally as blunt lobe, medial margin with 2 hook setae, distal margin with 1 stout pappose and 4 simple setae; ischium absent; merus with 1 pappose seta; carpus with 5 comblike setae medially, field of pappose setae, and 1 pappose seta laterally; propodus with simple and pappose setae medially, with 2 plumose setae laterally; dactylus with 1 long plumose seta and 4 simple setae (fig. 1H).

Maxilliped 2 basis as long as next 4 articles together, with 4 plumose seta distally and 2 simple setae laterally; ischium present, unarmed; merus with 1 plumose seta medially and 1 plumose seta laterally; carpus with 4 plumose setae medially and 1 plumose seta laterally; propodus with 3 plumose and 3 simple setae medially, 1 plumose and 1 simple setae laterally; dactylus with 2 simple setae terminally (fig. 1I).

Maxilliped 3 basis as long as all other articles together, not expanded distally, with plumose setae medially and laterally; ischium present, unarmed; merus with 2 plumose setae laterally and 1 medial plumose seta; carpus with 4 plumose setae medially, 2 plumose setae laterally; propodus with 4 simple and 4 pappose setae medially, 1 simple and 3 pappose setae laterally; dactylus with 3 simple setae terminally; exopod as long as basis, basal article margin serrate (fig. 2A).

Pereopod 1 basis as long as next 4 articles together, medial and lateral margins serrate distally, with plumose setae medially and laterally; ischium with 1 plumose seta; merus margin serrate, with 4 plumose setae; carpus with 6 simple setae; propodus with 8 simple setae; dactylus with 5 short simple setae and 2 long setae terminally; exopod as long as basis, basal article with 4 pappose setae (fig. 2B).

Pereopod 2 basis as long as next 4 articles together, lateral margin serrate, with 5 simple setae; ischium with 1 simple seta; merus with 1 simple and 1 stout microserrate setae; carpus 0.6 basis length, with 9 stout microserrate setae medially, 1 simple seta laterally; propodus with 1 simple seta; dactylus broken, with simple setae; exopod 0.8 basis length, basal article with 1 simple seta (fig. 2C).

Pereopod 3 basis longer than all other articles together, with 1 plumose and 1 simple setae; ischium with 1 simple seta; merus unarmed; carpus with 2 annulate setae; propodus with 1 annulate seta; dactylus with 3 simple setae terminally; exopod rudimentary, of 2 articles, with 3 simple setae terminally (fig. 2D).

Pereopod 4 basis longer than all other articles together, margin serrate, with 1 simple and 1 plumose setae; ischium with 1 simple seta; merus unarmed; carpus with 2 annulate setae; propodus with 1 annulate seta; dactylus with 3 simple setae terminally; exopod rudimentary, of 2 articles, with 2 simple setae terminally (fig. 2E).

Pereopod 5 entire shorter than basis of pereopod 4; basis as long as next 4 articles together, with 2 pedunculate, 1 plumose and 1 simple setae; ischium unarmed; merus unarmed; carpus with 1 simple and 2 annulate setae; propodus with 1 annulate seta; dactylus with 1 simple seta terminally (fig. 2F).

Telson 2.2 length of pleonite 6; lateral margins serrate anteriorly, with 5 microserrate setae; 3 microserrate setae terminally (fig. 2G).

Uropod peduncles 2.8 length of pleonite 6, longer than telson, with 10–11 medial microserrate setae with subterminal setule. Uropod endopod of 3 articles, subequal to uropod peduncle; article 1 longest, with 7 medial microserrate setae with single subterminal setule, 2 lateral simple setae; article 2 with 1 microserrate seta with single subterminal setule; article 3 with 1 microserrate seta with single subterminal setule, terminal seta broken. Uropod exopod of 2 articles, shorter than endopod; article 1 0.2 length of article 2, unarmed; article 2 with 2 simple setae, terminal seta broken (fig. 2G).

Subadult males (not figured) with 3 pairs of pleopods and otherwise similar to females.

Etymology. The species is named *poorei* in honor of Gary C. B. Poore on the occasion of his retirement from the Museum of Victoria as a tribute to all his many contributions to both carcinology and carcinologists.

Distribution. Victoria, continental slope, 1840 m.

Remarks. There are 8 other species of *Paralamprops* with a toothed marginal carina, *P. aspera* Zimmer 1907, *P. carpusserratus* Mühlenhardt-Siegel, 2005, P. *corollifera* Gamô, 1990, *P. girardi* Reyss, 1978, *P. margidens* Day, 1978, *P. semiornatus* Fage, 1929, *P. serratocostata* Sars, 1887, and *P. tuberculata* Roccatagliata, 1994. *Paralamprops aspera* and *P. serratocostata* are easily separable from *P. poorei* by the presence of additional toothed carinae on the carapace; in *P. poorei*, the only carina is the marginal carina. *Paralamprops carpusserratus* can be distinguished from the new species by the nearly circular carapace, the unequal antennular flagellae, the serrated carpus of pereopod 2, the reduced pereopod 5 and the 2 lateral setae on the telson; in *P. poorei* the carapace is longer than wide, the antennular flagellae are subequal, the carpus of pereopod 2 is not serrated, pereopod 5 has the same article proportions as pereopods 3 and 4, and 5 lateral setae are present on the telson. *Paralamprops girardi* can be distinguished from the new species by the equal rami of the uropod and the presence of 4 stout setae on the carpus of pereopod 2; in *P. poorei* the uropod exopod is shorter than the endopod and there are 9 stout setae on the carpus of pereopod 2. *Paralamprops*

margidens can be distinguished from *P. poorei* by the presence of a toothed dorsal crest on the carapace, 4 lateral setae on the telson and 3 setae medially on the uropod peduncle; in *P. poorei* there is no toothed dorsal crest, 5 lateral setae on the telson, and 10–11 medial setae on the uropod peduncle. *Paralamprops semiornatus* can be distinguished from *P. poorei* by the toothed dorsal crest on the carapace and the presence of a maxillule palp with 2 setae; in *P. poorei*, there is no toothed dorsal crest on the carapace, and the maxillule is without a palp. *Paralamprops tuberculata* can be distinguished from *P. poorei* by the expanded, "winglike" article 1 present in the antennules (Roccatagliata, 1994); in *P. poorei* the first article of the antennule is not expanded.

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Parelasmopus poorei a New Species of Maeridae (Crustacea: Amphipoda) from Southern Australia

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Abstract Hughes, L.E. 2009. *Parelasmopus poorei* a New Species of Maeridae (Crustacea: Amphipoda) from Southern Australia. *Memoirs of Museum Victoria* 66: 77–80.

This paper describes the maerid amphipod *Parelasmopus poorei* sp. nov. from southern Australia. This is the sixth species in the genus *Parelasmopus* recorded in Australia and the twelfth for the world.

Keywords Crustacea, Amphipoda, Maeridae, *Parelasmopus poorei*, new species, Australia, Taxonomy

Introduction

Parelasmopus Stebbing, 1888 is an Indo-West Pacific genus of benthic amphipods. *Parelasmopus* was recently placed in the family Maeridae (Krapp-Schickel, 2008). To date, Australia has the largest number of recorded taxa within this genus, six species: *Parelasmopus cymatilis* Lowry & Hughes, 2009, *P. echo* Barnard, 1972, *P. poorei* sp. nov., *P. sowpigensis* Lowry & Springthorpe, 2005, *P. suensis* (Haswell, 1879), and *P. ya* Barnard, 1972.

Materials and Methods

Material was dissected in 80% ethanol. Permanent slides were made using Aquatex™ mounting media. Scientific illustrations were made using Leitz Laborlux K and Wilde Heerbrugg stereomicroscopes fitted with camera lucida. Abbreviations for parts are as follows: **A** - antenna, **F** - accessory flagellum, **G** - gnathopod, **LL** -labium, **Mx1**- maxilla 1, **P** - pereopod, **T** - telson and **U** - uropod.

Descriptions were generated from a DELTA database (Dalwitz, 2005) to Maeridae genera and *Parelasmopus* species of the world. Species diagnosis is provided in **bold** text within the description. Species examined are lodged in the Museum Victoria (MV).

Maeridae Krapp-Schickel 2008

Parelasmopus Stebbing, 1888

Parelasmopus poorei **sp. nov.**

(Figs 1, 2)

Type locality. West of Point Ricardo, Victoria, Australia.

Type material. Holotype male, 11.0 mm, 4 slides, MV J 60148; paratype female, 13.5 mm, 1 slide, MV J 60147; paratypes J25634, 56 specimens, 11.7 km West of Point Ricardo, Eastern Bass Strait, (37° 49' 53" S 148° 30' 08" E), 27 m, February 1991, coll N. Coleman (MSL-EG 105).

Additional material examined. 14 specimens, MV J25632, 11.7 km west of Point Ricardo, Eastern Bass Strait, (37° 49' 53" S 148° 30' 08" E), 27 m, 4 June 1991, coll. N. Coleman (MSL-EG 78); 38 specimens, MV J25633, 11.7 km west of Point Ricardo, Eastern Bass Strait, (37° 49' 53" S 148° 30' 08" E), 27 m, February 1991, coll. N. Coleman (MSL-EG 104); 2 specimens, MV J25635, 14.3 km west south west of Point Ricardo, Eastern Bass Strait, (37° 50' 44" S 148° 28' 24" E), 32 m, 26 September 1990, coll. N. Coleman (MSL-EG 46); 25 specimens, MV J25636, 11.7 km west of Point Ricardo, Eastern Bass Strait, (37° 49' 53" S 148° 30' 08" E), 27 m, 4 June 1991, coll. N. Coleman (MSL-EG 77); 58 specimens, MV J25637, 11.7 km west of Point Ricardo, Eastern Bass Strait, (37° 49' 53" S 148° 30' 08" E), 27 m, Smith-McIntyre grab, February 1991, coll. N. Coleman (MSL-EG 103); 10 specimen, MV J56869, 8 km south of South East Point, Wilsons Promontory, Eastern Bass Strait, (39° 12' 54" S 146° 27' 18" E), 65 m, epibenthic sled, 18 November 1981, (BSS 180); 5 specimens, MV J57018, Cliff Head, 30 km south of Dongara, (29° 32' 00" S 114° 59' 00" E), 2.0 m, 22 April 1986, (SWA 85); 3 specimens, MV J57145, North Lumps, 2 km off Mullaloo, (31° 47' 18" S 115° 42' 48" E), 8.0 m, 2 May 1986, (SWA 112); 3 specimens, MV J57203, North Lumps, 2 km off Mullaloo, (31° 47' 18'S, 115° 42' 48'E) 7.0 m, 2 May 1985, coll. H. M. LewTon and G.C.B. Poore (SWA 113); 6 specimes MV J57199, north end of Little Beach, Two Peoples Bay, (34° 58' 24's, 118° 11' 42'E), depth unknown, 5 April 1984, coll. H. M. LewTon and G.C.B. Poore (SWA10).

Description. Based on holotype male, 11.0 mm, 4 slides, MVJ60148.

Head. *Head* eyes ovate; lateral cephalic lobe broad, truncated, anteroventral margin with notch. *Antenna 1* longer than antenna 2; peduncular article 1 subequal to article 2, with

Figure 1. *Parelamopus poorei* n. sp.: holotype male, 11.0 mm, MVJ60148. Scales for Md, F, Mx1 and LL represent 0.2 mm. Scales for U1-3 and T represent 0.5 mm.

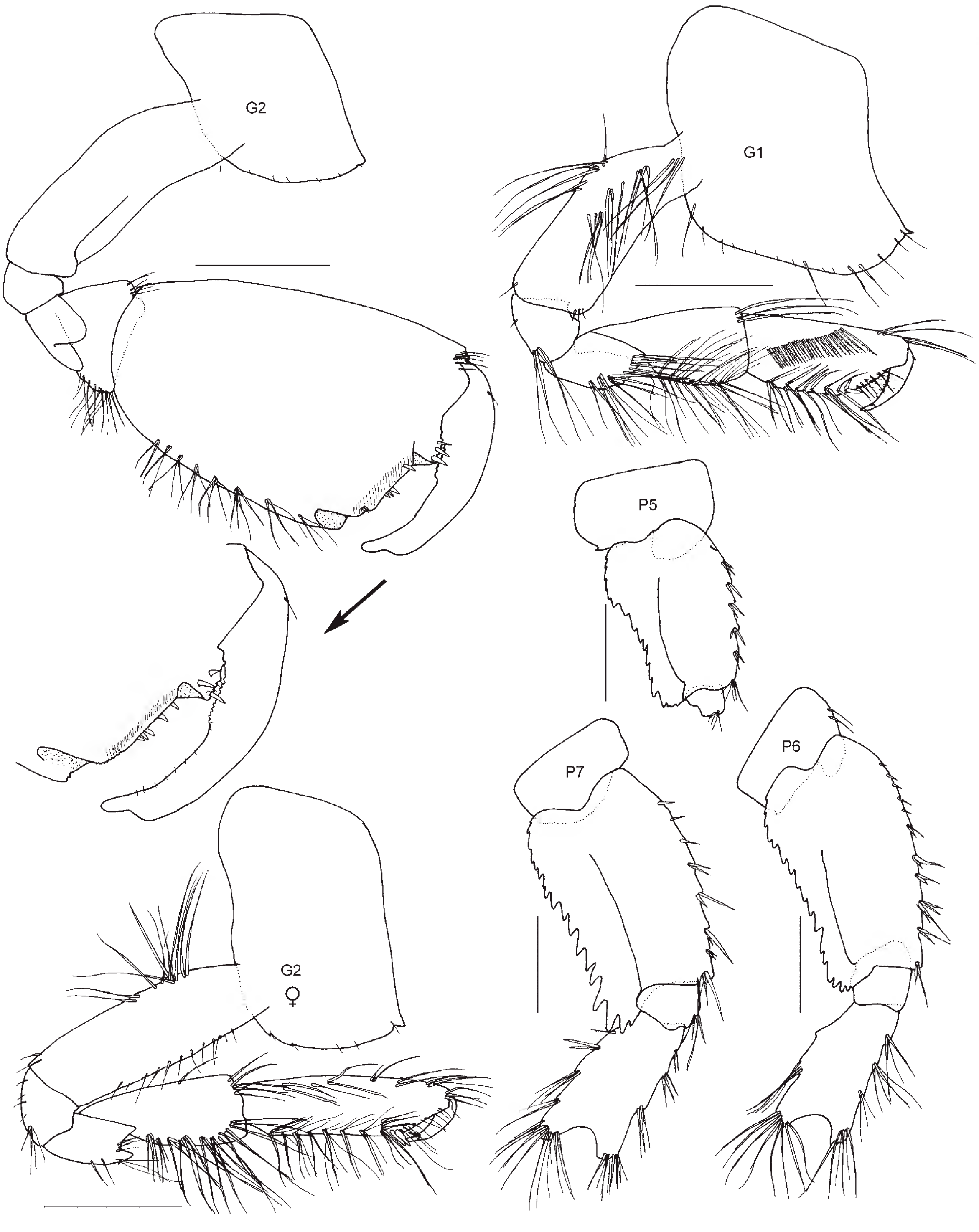

Figure 2. *Parelamopus poorei* n. sp.: holotype male, 11.0 mm, MVJ60148, paratype female, 13.5 mm, MV J 60147. Scales represent 0.5 mm.

2 robust setae along posterior margin; article 2 longer than article 3; flagellum with 34+ articles; accessory flagellum short with 5 articles. *Antenna 2* peduncular article 2 cone gland reaching beyond end of peduncular article 3; article 4 longer than article 5; flagellum with 19 articles. *Mandible* accessory setal row well developed with 4 setae; molar well developed, triturative; mandibular palp present, 3-articulate; article 1 swollen along entire article, four times as long as broad, longer than article 2; article 2 shorter than article 3; article 3 long (more than six times as long as broad), article 3 subequal in length to article 1, with 2 long slender apical setae.

Pereon. *Gnathopod 1* coxa anterior margin concave, anteroventral corner produced, acute; carpus about twice as long as broad, longer than propodus; propodus palm subacute, straight, entire, defined by posterodistal corner, with 2 posterodistal robust setae. ***Gnathopod 2*** subchelate; basis slender; carpus compressed, lobate, projecting between merus and propodus; propodus massive, with clusters of slender setae along posterior margin, palm straight, smooth, about one third length of propodus, with subrectangular distomedial shelf, with 3 robust setae on shelf, palmar margin with groups of robust setae, **facial margin forming broad tabular blade (heavily calcified), posteroventral corner defined by 90° angle**, without posterodistal robust setae, facial margin with dactylar socket; **dactylus with crenulated posteroproximal shelf**, reaching end of palm, **closing into socket, with apical restriction**. *Pereopod 4* coxa posteroventral lobe well developed, with rounded posteromedial corner. *Pereopods 5–7* **basis posterior margin heavily serrate**, without long slender setae, merus not broadened. *Pereopod 5* basis linear; posterior margin concave, posteroventral corner serrate. *Pereopod 6* basis posterior margin straight, posteroventral corner serrate. *Pereopod 7* basis posterior margin straight, posteroventral corner produced posterodistally, lobate, with acute serrate process; propodus not expanded posterodistally. *Pereonite 7* dorsally bicarinate.

Pleon. ***Pleonite 1-3* dorsally bicarinate**. *Epimeron 1-2* posteroventral corner with small acute spine. *Epimeron 3* ventral margin serrate distally, posteroventral margin serrate below posteroventral corner, posteroventral corner with strongly produced acute spine. *Urosomite 1* bicarinate. *Uropod 1* peduncle with basofacial robust seta. *Uropod 3* rami distally truncated to subacute, with long and short apical robust setae; inner ramus longer than peduncle, subequal in length to outer ramus; outer ramus three times as long as broad. *Telson* deeply cleft, as long as broad, lobes divergent, distally truncated, with 4 - 5 long apical robust setae.

Female (dimorphic characters). Based on paratype female, 13.5 mm, MV J60147.

Pereon. ***Gnathopod 2* carpus very long about, 2.5 times as long as wide**, not lobate, not enclosed by merus and propodus; propodus linear, about four times as long as broad, without distomedial shelf; dactylus without posteroproximal shelf, apically subacute.

Remarks. *Parelasmopus poorei* sp. nov. can be distinguished from other species of *Parelasmopus* by the male gnathopod 2 propodus with the calcified straight blade-like palm and the dactylus distal apical constriction which closed into a socket on the medial side of the propodus palm. In male juvenile specimens, about 6 mm, the gnathopod 2 constricted dactylus has not developed.

Parelasmopus poorei sp. nov. male gnathopod 2 propodus palm is defined by a right angle corner similar to *P. cymatilis* Lowry & Hughes, 2009, *P. setiger* Chevreux, 1901, *P. suluensis* (Dana, 1852), *P. suensis* (Haswell, 1879) and *P. zelei* Ledoyer, 1982. The combination of pereopods 5 - 7 basis with heavily serrate posterior margin and bicarinate pleonite 3 further distinguishes *P. poorei* sp. nov. and *P. cymatilis* from these species. The lack of serrations on the gnathopod 1 coxa separates *P. poorei* from *P. cymatilis*.

Distribution. *Australia*. Victoria: Point Ricardo, Wilsons Promontory. Western Australia: Dongara, Two Peoples Bay, Mullaloo (current study).

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Compoceration garyi, a new genus and species of Paramunnidae (Crustacea, Isopoda, Asellota), from so~~uth~~ eastern Australia.

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Abstract

Just, J. 2009. *Compoceration garyi*, a new genus and species of Paramunnidae (Crustacea, Isopoda, Asellota), from south-eastern Australia. *Memoirs of Museum Victoria* 66: 81–84.

A new genus, *Compoceration*, in the asellote family Paramunnidae Vanhöffen, 1914 is diagnosed. The type species *Compoceration garyi* sp. nov. was collected from 220 m depth off southern New South Wales. The new species shares several characters with *Pentaceration* Just, 2009. It differs from the latter mainly in its unique head structures and a cylindrical, non-flared mandible molar.

Keywords Crustacea, Isopoda, Paramunnidae, *Compoceration garyi* new genus and species, Australia.

Introduction

Asellote isopods of the family Paramunnidae from Australia and adjacent subantarctic islands have recently been the subject of major revisionary studies (Just & Wilson 2004, 2006, 2007, Just 2009). As a result, many new species of much morphological novelty have been described and new genera established, while several 'old' genera (primarily *Paramunna* Sars, 1866, *Austrimunna* Richardson, 1906, *Austrosignum* Hodgson, 1910, and *Munnogonium* George and Strömberg, 1968) have been redefined. Among the many paramunnids still to be studied from the area, a single female stands out immediately because of its unusual ornamentation on the cephalon. This new species is here made the type of a new genus as *Compoceration garyi* gen. et sp. nov.

Terminology and measurements follow those used in the suite of papers by Just and Wilson (see above) with additions in Just (2009). The single specimen to hand lacks parts of the antennae and most pereopods. To avoid destroying the holotype, some mouthparts only were drawn in situ.

Compoceration gen. nov.

Type species. *Compoceration garyi* sp. nov. Here designated.

Diagnosis. *Body* generally tapering from pereonite 3. *Eyestalks* elongate, overreaching pereonite 1 lateral margins. *Frontal margin* of head with two lateral forward pointing spines and upright outgrowths at base of spines. *Pereonites* laterally extended into broad spines. *Coxae* hidden under extended tergites in dorsal view. *Pleotelson* lateral margins denticulate, posterior margin produced. *Antennula* article 1 length and width subequal to 2. *Antenna* article 3 tubular. *Mandible* palp present, stubby, molar long, cylindrical throughout, with transverse grinding surface. *Pereopod I* carpus oval, with two straight robust setae on posterior margin; propodus narrowing distally to insertion of dactylus. *Female operculum* ovoid. *Uropods* on dorsal surface of pleotelson.

Remarks. It should be borne in mind that the diagnosis is based on the female of the species. Males should be identifiable on the shape and armature of the head, the eyestalks and the general shape of the body. Lateral pereonite 1 and spines on the remainder may be more strongly developed in males, though, and pereopod I may differ significantly, especially the shape of the carpus.

Etymology. The new genus name is composed of the Greek κομπος (kompos = knot or lump) and κέρατο (kerato = horn) with the diminutive ending –ion, thus a little horn with a knot, alluding to the complex head spines.

Compoceration garyi sp. nov.

Figures 1–2

Material examined. Holotype, ovigerous female, 0.9 mm, Australia, New South Wales, off Eden 36°57.40'S 150°18.80'E, 220 m, muddy shell, WHOI epibenthic sled, 20 July 1986, Poore *et al*., RV *Franklin*, stn SLOPE 21, Museum Victoria NMV J18982 (incl. 2 slides).

Description. *Body* widest between pereonites 2 and 3, width 0.42 length. *Head* length 0.25 width (including eyestalks); length posterior to eyestalks 0.63 anterior length. *Frontal margin* with low convex bulge in middle; lateral spines approximately 0.7 length of eyestalks, pointing forward at about 50° to head midline, length/width at base approximately

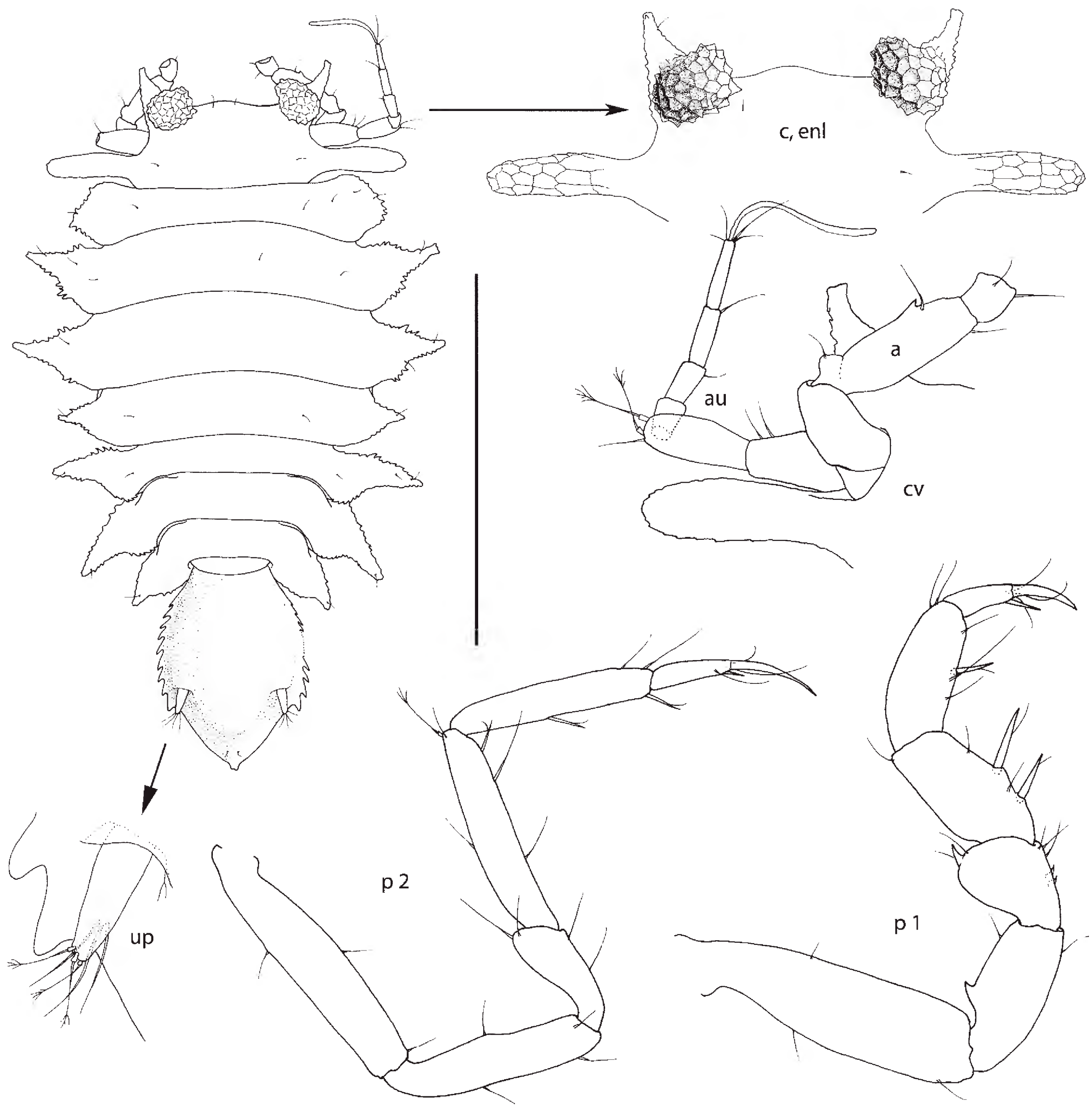

Figure 1. *Compoceration garyi* gen. et sp. nov. Holotype, ovigerous female. a, antenna; au, antennula; c, enl, dorsal view of head enlarged; cv, ventral view of head; p1 and 2, pereopods I and II; up, uropod. Scale bar for habitus: 0.5 mm.

1.4: dorsal outgrowth at base of spine spherical, diameter approximately 1.5 spine width at base, with heavily calcified sculptured surface. *Eyestalks* overreaching anterior lateral corner of pereonite 1 by about 1/2 their length, pointing laterad at 90° to head midline, anterior and posterior margins parallel, apex rounded, ocelli not observed.

Pereonite 1 length half midlength of pereonite 2, 3 1.5 length of pereonite 2, 4 length equalling pereonite 2, 5 length equals pereonite 1, 6 1.3 length of pereonite 5, 7 length equals pereonite 5. Pereonite 1 lateral margins irregularly rounded truncate, broadest at midpoint; pereonites 2–7 lateral margins extended into broad-based pointed spines with fine marginal denticles;

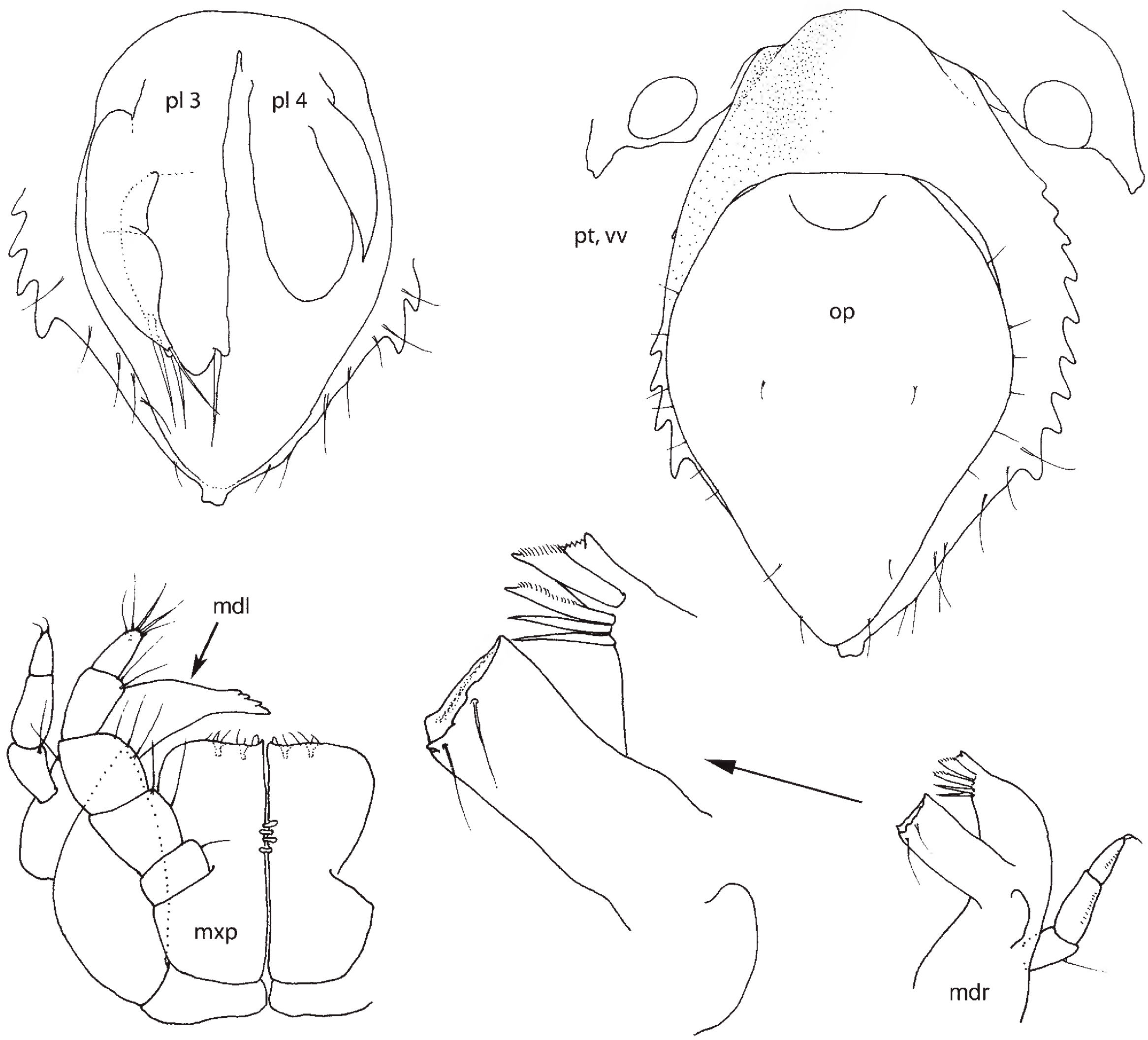

Figure 2. *Compoceration garyi* gen. et sp. nov. Holotype, ovigerous female. mdr, right mandible, with enlargement; mdl, left mandible; mxp, maxilliped; op, female operculum (pleopod II); pl3 and 4, pleopods III and IV; pt vv, pleotelson, ventral view.

pereonites 2 and 3 spines similar, approximately 0.3 length of pereonite width, spine on 4 reduced compared to 3 and 5, spine on 5 and 6 similar to 2 and 3, on 7 slightly shorter than 6; spines on 6 and 7 pointing backward at approximately 45 degrees.

Pleon length 1.4 width. *Pleonite 1* width 0.85 distance between uropods, length 0.2 width. *Pleotelson* without noticeable neck or shoulders, lateral margins evenly convex to level of uropods, with 9 denticles on left side (partly broken on right); posterior margin 0.33 length of entire pleotelson, broad, merging straight into lateral margin except for distal denticle of the latter, triangular at 85°, apex a tiny square knob.

Antennula articles 1 and 2 combined reaching apex of eyestalk; 3 and 4 of equal length, both 0.6 length of subequal 5 and 6.

Antenna article 1 in ventral view approximately 0.4 length of article 2 along lateral margin; article 3 width 0.3 length, with small denticle in distal half of lateral margin, narrowing in distal 1/3.

Pereopod I basis length 3.6 times width; ischium 0.5 length of basis, anterior margin with single acute spine in proximal half; merus with single acute spine on anterior margin; carpus margin distal to robust setae straight; propodus with single

robust seta on posterior margin. Pereopod II propodus with 2 slender robust setae on posterior margin.

Pleopod II (female operculum) distolateral margins nearly straight, width 0.72 length.

Uropods recessed into simple non-protruding cuticle pockets, with single ramus (endopod), length 3 times width.

Etymology. The species is named for Dr Gary Poore, Museum Victoria, Melbourne, Australia, in recognition of his contributions to many aspects of isopodology, and in gratitude for much help over decades.

Discussion. Among the paramunnids with dorsally covered coxae, especially on pereonites 5–7, the new genus *Compoceration* share several characteristics with *Pentaceration* Just, 2009: spines on the frontal margin of the head; elongate eyestalks; article 2 of the antennal peduncle about 3 times longer than 1; pereopod I carpus oval; pereonites 2–7 laterally extended into spines; pereonite 4 width reduced (although not as strongly as in *Pentaceration*). *Compoceration* differs from *Pentaceration* (character in parentheses) as follows: front margin of head with 2 lateral spines with dorsal outgrowth at their base (3 spines, 1 mid-frontal, 2 lateral, no basal outgrowth); eyestalks 4 times longer than wide (2–3 times); mandible molar cylindrical, not distally expanded (strongly expanded distally, 'flared'). By analogy with *Pentaceration*, it is possible that these differences are more strongly expressed in the as yet unknown males of *Compoceration*.

Species in *Paramunna* also have head ornaments, but they are in the shape of 2 dorsomarginal broad, square or rounded lobes (small pointed lobes in one species) that do not appear to be homologous with the above mentioned frontal margin spines. Generally *Paramunna* species have ovoid bodies with rounded to truncate pereonite margins. Only in terminal males of *Paramunna bilobata* Sars, 1866 and the somewhat aberrant *P. walvisensis* Just and Wilson, 2004 are pereonites extended laterally into broad pointed laplets, especially on the last 3 pereonites. *Paramunna* species otherwise differ from *Compoceration* in most other diagnostic characters: peduncle article 2 of antenna short, about as long as 1; eyestalks about as long as wide, not overreaching pereonite 1; mandible molar expanded distally, 'trumpet-shaped'; pereopod I carpus triangular; pereonite 4 similar to 3 and 5; uropods inserted in pleotelson margin, not on dorsal surface, bi-ramous.

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Redescription of the freshwater amphipod *Austrochiltonia australis* (Sayce) (Crustacea: Amphipoda, Chiltoniidae)

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Abstract

King, R.A. 2009. Redescription of the freshwater amphipod *Austrochiltonia australis* (Sayce) (Crustacea: Amphipoda, Chiltoniidae). *Memoirs of Museum Victoria* 66: 85–93.

Austrochiltonia is an abundant yet taxonomically poorly known freshwater amphipod genus. With two species recognised, they are inadequately defined yet widely identified throughout southern Australian freshwater systems. In an effort towards providing a clear diagnosis of *Austrochiltonia*, its type species, *A. australis*, is re-described from type material. Two distinct male morphotypes are described for the first time and morphological variability within the species is discussed.

Keywords

Crustacea, Amphipoda, Freshwater, Australia, Chiltoniidae, *Austrochiltonia*, *australis*, *subtenuis*

Introduction

The recent discovery of significant diverse genetic lineages of Australian freshwater amphipods in the family Chiltoniidae and the varied phenotypic expression of this diversity (King, in press; Murphy et al. 2009) has highlighted a need for modern taxonomic revision of this group. Two genera are currently known from Australia: *Austrochiltonia* Hurley, 1959 and *Phreatochiltonia* Zeidler, 1991. *Austrochiltonia* with its three existing species (*A. australis* (Sayce, 1901), *A. dalhousiensis* Zeidler, 1991 and *A. subtenuis* (Sayce, 1902)) remains poorly defined, primarily due to confusion surrounding the identification of *A. australis*, the type species.

Sayce (1901) originally described *Hyalella australis* without designating type material or a type locality. He did note that the species was common in Victoria (the lagoons of the River Yarra, Fernshaw, Christmas Hills, Heidelberg, East Kew, Melbourne Botanical Gardens, Elwood swamp) and also in Lake Petrarch, Tasmania. One year later Sayce (1902) described *Chiltonia subtenuis* from Lake Hindmarsh in Victoria and transferred *H. australis* to this genus. Later, both species were transferred to *Austrochiltonia* by Hurley (1959) who restricted *Chiltonia* to New Zealand species based on specialised male pleopod morphology.

With incomplete original descriptions, slight morphological differences between the two species (antennal lengths and presence of the uropod 3 with one or two articles), and overlapping distributions, the validity of *A. australis* and *A. subtenuis* were to some researchers questionable (Hurley 1954, Smith and Swain 1982). Yet, over subsequent years both species were identified throughout southern Australia. *Austrochiltonia australis* was collected by Smith (1909) from Tasmania, by Chilton (1923) from New South Wales and Victoria, by Hurley (1959) from Lake Leake in Tasmania and by Williams (1962) in Victoria, New South Wales and Tasmania. *Austrochiltonia subtenuis* was collected by Hale (1929) from the Murray River in South Australia and by Williams (1962) from Victoria, Tasmania and Western Australia.

In an attempt to solve the problem, both *A. australis* and *A. subtenuis* were redescribed by Williams (1962), who also selected types, from the Sayce collection in Museum Victoria from locations in Victoria, New South Wales, and Tasmania (material that, according to Williams (1962), Sayce used for his original descriptions of both species). Williams upheld the antennal and uropodal characters separating the *A. australis* and *A. subtenuis* and designated "lectoholotypes", "lectoallotypes" and "lectoparatypes". He chose "Yarra Lagoon, East Kew" to be the restricted type locality for *A. australis* recording that Sayce's illustrations indicated that the specimen originally illustrated was from that locality (the author notes that this locality is more than likely to be the existing "Kew Billabong" which is currently dry). Lake Hindmarsh, in Victoria, was chosen as the type locality for *A. subtenuis* (the author notes that this locality is also currently dry).

By modern standards, William's (1962) descriptions lack sufficient detail to be informative. Two new Australian genera have recently been discovered (King, in press), defined by new sets of morphological characters not fully illustrated by Williams. In addition to this, examination of the type material

of *A. australis* (designated by Williams) showed a greater degree of morphological diversity among males than was reported by Williams (1962). Therefore it was deemed necessary to redescribe the species as a first step towards a robust definition of the genus *Austrochiltonia*. The type material of *A. subtenuis* (designated by Williams) was not located after searches of the collections of Museum Victoria, the South Australian Museum and the Australian Museum. Collections at and around Lake Hindmarsh are currently being coordinated as part of an effort to properly determine the status of that species.

Systematics

Infraorder Talitrida Rafinesque, 1815

Superfamily Talitroidea s.s. Rafinesque, 1815 (Serejo, 2003)

Family Chiltoniidae Barnard, 1972 (Serejo, 2003)

Austrochiltonia australis

Figures 1–4

Synonymy.

Hyalella australis Sayce, 1901: 226–30, pl. xxxvi.

Chiltonia australis Sayce, 1902: 47–48.—?Smith 1909: 70.—?Chilton, 1923: 95.

Austrochiltonia australis Hurley, 1959: 765-767.—Williams, 1962: 202-208, figs. 1A-I, 3A-O.—Lowry and Stoddart, 2003: 127.

Material Examined. Lectotype, NMV J11248, male, 8.1mm, Yarra Lagoon, East Kew, Victoria, coll. O.A. Sayce. Paralectotype, NMV J11247, female, 6.2mm, collection information same as for J11248. Paralectotype, NMV J11249, 8 males (11.4mm, 10.5mm 10mm, 9.5mm, 8.1mm, 7.7mm, 4.7mm, 3.3mm), 4 females (8.6mm (ovigerous), 6.1mm, 5.6mm (ovigerous), 3.9mm). NMV J46778, male, 7.3mm, collection information same as for NMV J11249. NMV J46779, male, 6.8mm, collection information same as for NMV J11249. NMV J46780, female (ovigerous), 8.2mm, collection information same as for NMV J11249.

Distribution. Yarra River and tributaries, Victoria, Australia (Type Locality: Kew Billabong, Melbourne, Victoria (previously called the Yarra Lagoon, East Kew)).

Description. Male (based on large male NMV J46778), length: 7.3mm. Head about as long as deep (fig. 1A). Antenna 1 (fig. 1C) peduncular article 1 1.8 times as long as broad, inner lateral margin with three robust setae, ventral-distal margin with single robust seta; peduncular article 2 shorter than article 1 (0.8 times as long), 2.5 times as long as broad; peduncular article 3 similar length to article 2, 2.8 times as long as broad; flagellum slightly longer than peduncle, of 11 articles, with ventral aesthetascs on the proximal margins of the seven distal articles. Antenna 2 (fig. 1D) about 0.6 times length of antenna 1; peduncular article 3 broader than long, inner-distal margin with two robust setae; peduncular article 4 longer than article 3, 2 times longer than broad, inner lateral margin with three robust setae, distal margin with two robust setae; peduncular article 5 longer than article 4, 3.7 times as long as broad; flagellum slightly shorter than peduncle, of eight articles.

Upper lip (fig. 1I) broader than long, apically bluntly rounded, with numerous short setae along apical margin. Lower lip (fig 1J) with bluntly rounded lateral lobes, apical margins rounded, apical and inner margins with numerous short setae. Left mandible (fig. 1H) with incisor of six teeth, *lacinia mobilis* of five teeth, spine row of three plumose setae and triturative molar. Right mandible (fig. 1G) with incisor of six teeth, *lacinia mobilis* of three teeth, spine row of two plumose setae and triturative molar with a long plumose seta. Maxilla 1 (fig. 1B) outer plate with nine setulate robust setae; inner plate with two long apical plumose setae. Maxilla 2 (fig. 1F) outer plate with two apical rows of 12 simple setae; inner plate with two apical rows of 17 simple setae, with a plumose seta on the inner lateral margin. Maxilliped (fig. 1E) inner plate apical margin with two short spine-like robust setae, with plumose seta along apical and inner lateral margins; outer plate with numerous simple setae along apical and inner lateral margins; palp articles 1 and 2 similar width, palp article 2 with numerous simple setae on inner lateral margin; palp article 3 not as broad as articles 1 and 2, with numerous simple setae on inner lateral and distal margins, with three long settulate setae on outer distal margin; palp article 4 short, about 0.3 times as broad as article 3, with unguis and simple setae on distal and outer margins.

Gnathopod 1 (fig. 2A) coxa distally almost as broad as long, distal margin with 33 short simple setae; basis dorsal and ventral margins with scattered long simple setae, ventral distal corner with cluster of simple setae; ischium, and merus ventral distal corners with clusters of setae; carpus with ventral-lateral lobe and row of 13 setulate setae becoming longer distally, dorsal-distal margin with long settulate setae; propodus triangular in shape, 1.7 times as long as broad, ventral-distal corner with one robust seta (near where tip of dactylus touches), ventral-distal margin (adjacent to dactylus length) with short robust and long simple setae, dorsal-distal margin with long simple setae, inner face with 11 robust plumose setae; dactylus curved, fitting against ventral-distal corner of propodus, with dorsal plumose seta. Gnathopod 2 (fig. 2B) coxa short, 1.1 times as long as broad, distal margin with 14 short simple setae; basis dorsal and ventral margins with scattered simple setae; ischium and merus with scattered setae on ventral margins; propodus 1.6 times as long as broad, with proximal lobe covering distal margin of carpus, ventral-distal corner marked with two distinct carina-like lobes and a ventral-distal groove present on inner face to accommodate the tip of the dactylus, ventral distal margin with numerous apically bifid robust setae. Pereopod 3 (fig. 2C) coxa distal margin with 21 short simple setae; basis dorsal and ventral margins with scattered simple setae, ventral distal corners with clusters of setae; ischium ventral distal corners with clusters of setae; merus with distinct dorsal-distal lobe, dorsal margin with three clusters of simple setae, ventral margin with scattered simple setae, ventral distal corner with cluster of setae; carpus ventral margin with robust setae and scattered simple setae; propodus dorsal margin with three clusters of simple setae; ventral margin with nine clusters of robust and simple setae; dactylus dorsal margin with plumose seta, ventral margin with simple seta, unguis present. Pereopod 4 (fig. 2D) coxa with distinct proximal excavated corner, distal margin with 39 short simple setae; basis dorsal and ventral margins with scattered simple

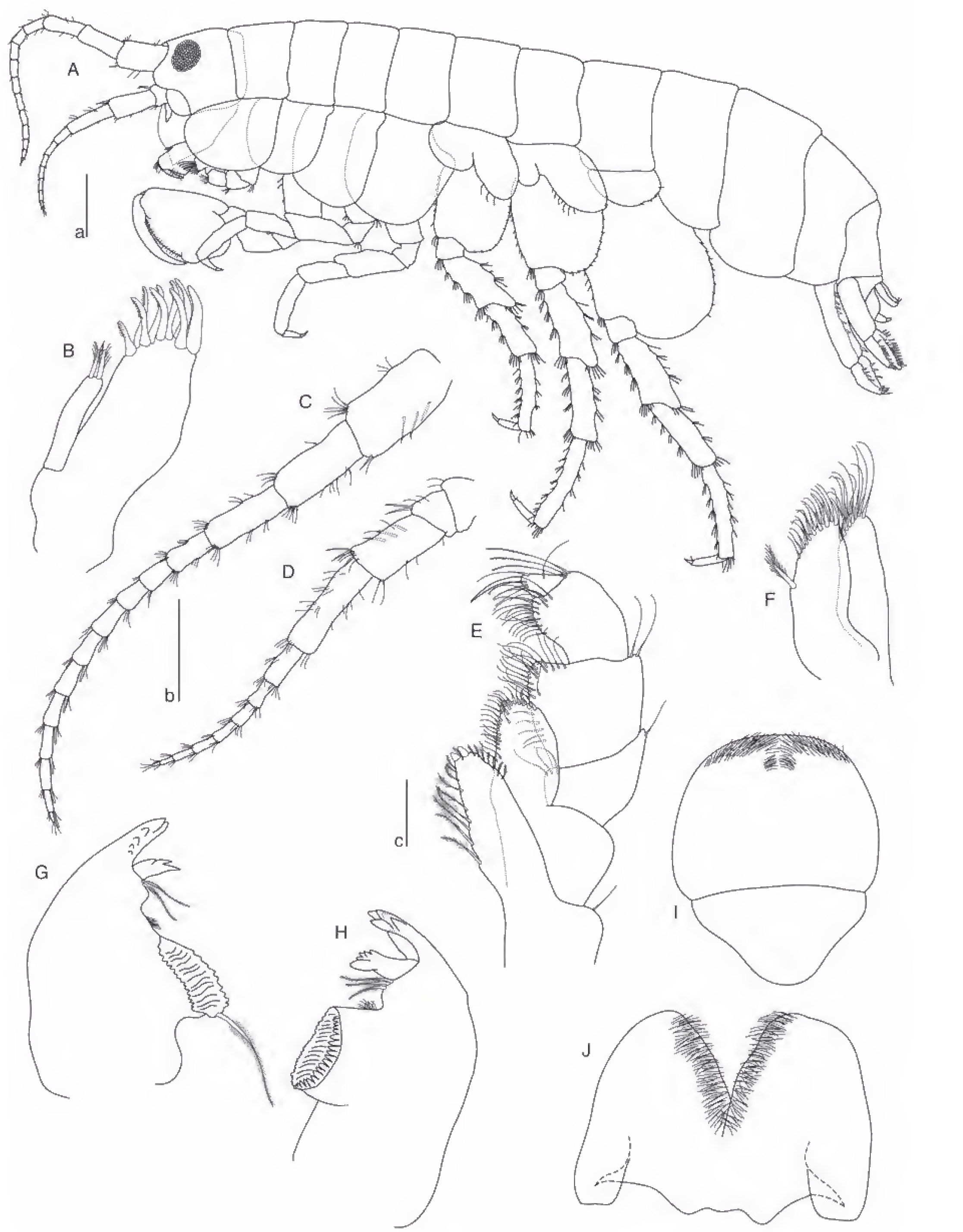

Figure 1. *Austrochiltonia australis* (Sayce), NMV J46778, large male morphotype, 10.5mm: A, Lateral view of body; B, maxilla 1; C, Antenna 1; D, antenna 2; E, maxilliped; F, maxilla 2; G, right mandible; H, left mandible; I, upper lip; J, lower lip. Scales: a(A), 0.5mm; b(C-D), 0.5 mm; c(B,E-H), 0.1mm.

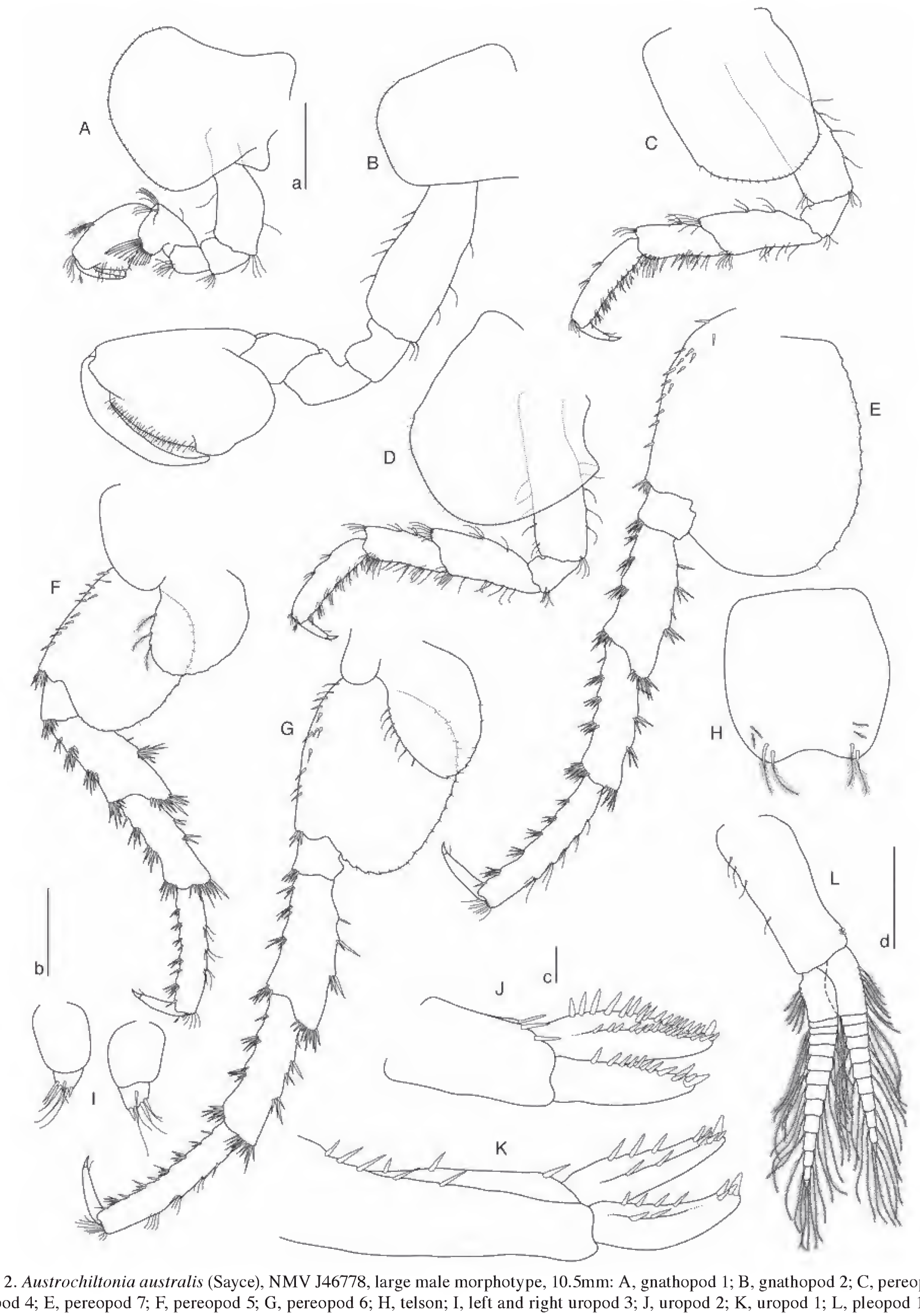

Figure 2. *Austrochiltonia australis* (Sayce), NMV J46778, large male morphotype, 10.5mm: A, gnathopod 1; B, gnathopod 2; C, pereopod 3; D, pereopod 4; E, pereopod 7; F, pereopod 5; G, pereopod 6; H, telson; I, left and right uropod 3; J, uropod 2; K, uropod 1; L, pleopod 1. Scales: a(A-G), 0.5mm; b(I), 0.1mm; c(H, J-K), 0.1mm; d(L), 0.5mm.

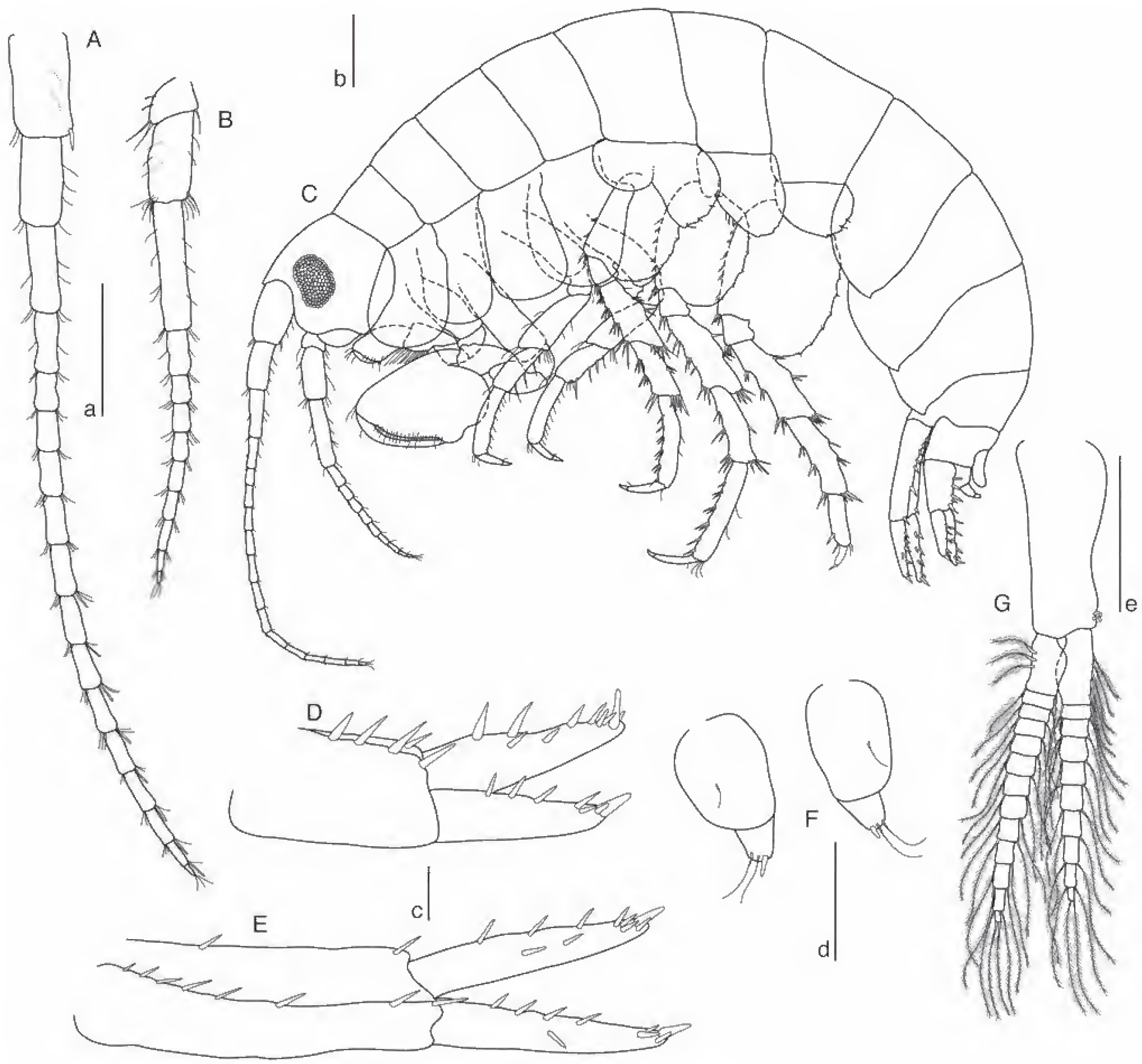

Figure 3. *Austrochiltonia australis* (Sayce), NMV J46779, small male morphotype, 4.7mm: A, antenna 1; B, antenna 2; C, lateral view of body; D, uropod 2; E, uropod 1; F, left and right uropod 3; G, pleopod 1. Scales: a(A-B), 0.5mm; b(C), 0.5mm; c(D-E), 0.1mm; d(F), 0.1mm; e(G), 0.5mm.

setae, ventral distal corner with cluster of simple setae; ischium ventral distal corner with cluster of setae; merus with distinct dorsal-distal lobe, dorsal margin with three clusters of simple setae, ventral margin with scattered simple setae, ventral distal corner with cluster of setae; carpus dorsal margin with three clusters of simple setae, ventral margin with scattered robust and simple setae; propodus ventral margin with eight clusters of robust and simple setae; dactylus dorsal margin with plumose seta, ventral margin with simple seta, unguis present. Pereopod 5 (fig. 2F) coxa anterior lobe with one short seta, posterior lobe with three long plumose setae and 9 short setae along margin; basis 1.2 times as long as broad, dorsal margin with 11 robust setae along length, dorsal-distal margin with seven robust setae, ventral margin subtly crenulated and with 24 short simple setae along length; ischium dorsal-distal margin with distal robust setae; merus with strong postero-distal lobe, dorsal margin with robust setae in four clusters, ventral margin with robust setae in three clusters; carpus as long as merus, dorsal margin with robust setae in four clusters, ventral margin with robust setae in three clusters; propodus

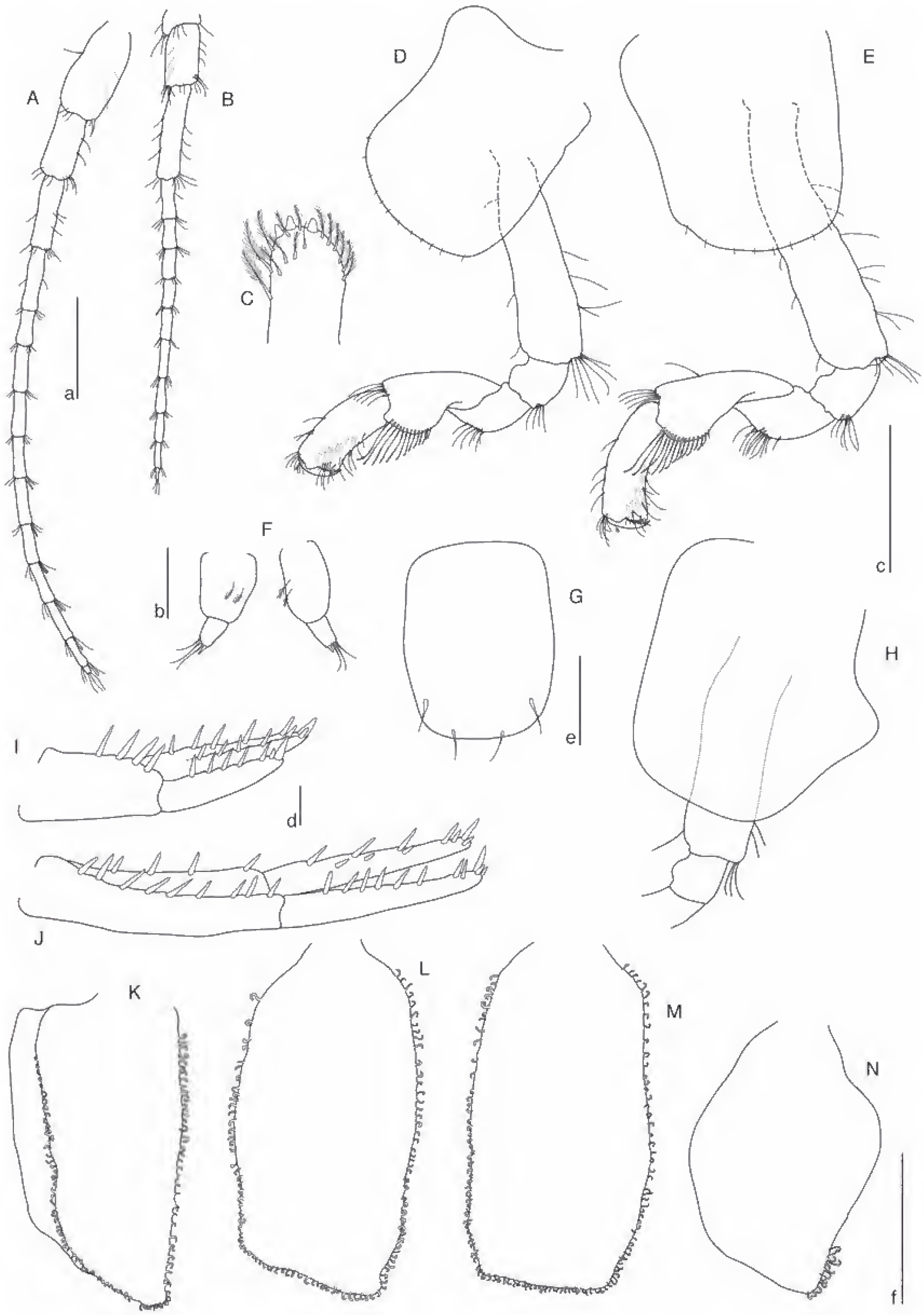

Figure 4. *Austrochiltonia australis* (Sayce), NMV J46780, ovigerous female, 8.6mm: A, antenna 1; B, antenna 2; C, inner plate of maxilliped; D, gnathopod 1; E, gnathopod 2; F, left and right uropod 3; G, telson; H, pereopod 4 coxa; I, uropod 2; J, uropod 1; K, oostegite on coxa 2; L, oostegite on coxa 3; M, oostegite on coxa 4; N, oostegite on coxa 5. Scales: a(A-B), 0.5mm; b(F), 0.1mm; c(D-E), 0.5mm; d(I-J), 0.1mm; e(G), 0.1mm; f(K-N), 0.5mm

longer than merus, dorsal margin with eight clusters of robust setae, ventral margin with three clusters of simple setae, ventral distal corner with cluster of simple setae; dactylus with plumose seta on ventral margin, unguis present. Pereopod 6 (fig. 2G) coxa posterior lobe with seven robust setae and seven short setae along margin; basis slightly longer than broad, dorsal margin with 12 robust setae along length, distal end of dorsal margin with cluster of robust setae, ventral margin subtly crenulated and with 23 short simple setae along length; ischium dorsal margin with distal robust setae; merus with strong postero-distal lobe, dorsal margin with robust setae in four clusters, ventral margin with robust setae in four clusters; carpus as long as merus, dorsal margin with robust setae in four clusters, ventral margin with robust setae in five distal clusters; propodus longer than merus, dorsal margin with nine clusters of robust setae, ventral margin with five clusters of simple setae; dactylus with plumose seta on ventral margin, unguis present. Pereopod 7 (fig. 2E) coxa ventral margin with five short simple setae; basis longer than broad, dorsal margin with 15 robust setae along length, distal end of dorsal margin with four robust setae, ventral margin subtly crenulated and with 18 short simple setae along length; ischium dorsal margin with distal cluster of robust setae; merus with strong postero-distal lobe, dorsal margin with robust setae in four clusters, ventral margin with robust setae in five clusters; carpus as long as merus, dorsal margin with robust setae in five clusters, ventral margin with robust setae in four distal clusters; propodus longer than merus, dorsal margin with six clusters of robust setae, ventral margin with six clusters of simple setae; dactylus with plumose seta on ventral margin, unguis present.

Pleopods 1-3 similar (fig. 2K), unmodified (as in *Chiltonia*), peduncle inner margins with two distal retinacula (coupling hooks).

Uropod 1 (fig. 2L) peduncle distinctly longer than rami, dorsal margin with five robust setae along the length of the outer margin and five along the inner margin; outer ramous with distal cluster of four robust setae and two rows of robust setae along length, outer margin with four robust setae, inner margin with two robust setae; inner ramous with distal cluster of six robust setae and two rows of robust setae along length, outer margin with two robust setae, inner margin with three robust setae. Uropod 2 (fig. 2J) peduncle similar length to rami, dorsal margin with three long robust setae; outer ramous slightly smaller than inner ramous, with distal cluster of four robust setae, with one row of eight robust setae along length; inner ramous with two rows of robust setae along length, outer margin with fourteen robust setae, inner margin with eighteen robust setae (distal cluster of setae obscured by rows of setae). Uropod 3 (fig. 2I) with two articles; first article 2.8 times longer than second article; second article distal margin with one short robust seta, and one to three long robust seta apically and one long seta subapically.

Telson (fig. 2I) slightly longer than broad, apically slightly concave with pairs of two long and two short plumose setae around each distal corner.

Small male (based on small male NMV J46779). Length: 6.8mm. Similar to large male except for the following: Antenna 1 (fig. 3A) flagellum of 14 articles, with ventral aesthetascs on the proximal margins of the eight distal articles. Antenna 2 (fig. 3B) flagellum of nine articles. Maxilliped inner plate apical margin with three spine-like setae. Gnathopod 1 (fig. 3C) coxa longer than broad, distal margin with 12 short simple setae. Gnathopod 2 (fig. 3C) coxa distinctly longer than broad, with seven short setae along margin. Pereopods 3 and 4 (fig. 3C) lacking setae along coxal margin and the dorsal margin of the propodus. Pereopods 5-7 (fig. 3C) with fewer coxal setae, with fewer numbers of setal clusters along articles.

Pleopod 1 (fig. 3G) rami with fewer articles than in large male.

Uropod 1 (fig. 3E) peduncle slightly longer than rami, dorsal margin with up to nine robust setae along the length of the outer margin and up to three along the inner margin; rami straight (not curved as in large male); outer ramous with distal cluster of four robust setae and two rows of robust setae along length, outer margin with four robust setae, inner margin with one robust seta; inner ramous with distal cluster of five or six robust setae and two rows of robust setae along length, outer margin with two robust setae, inner margin with three robust setae. Uropod 2 (fig. 3D) peduncle similar length to rami, dorsal margin with four to five long robust setae; outer ramous slightly smaller than inner ramous, with distal cluster of four robust setae, with one row of three robust setae along length; inner ramous with distal cluster of five robust setae, with two rows of robust setae along length, outer margin with two robust setae, inner margin with three to four robust setae. Uropod 3 (fig. 3F) second article distal margin with one short robust seta, and one to two long robust seta apically.

Female (based on female NMV J46780). Length: 8.2mm. Similar morphology to (large) male except for the following: Antenna 1 (fig. 4A) flagellum of 11 articles, with ventral aesthetascs on the proximal margins of the six distal articles. Antenna 2 (fig. 4B) flagellum of ten articles. Maxilliped inner plate apical margin (fig. 4C) with three spine-like setae. Gnathopod 1 (fig. 4D) coxa longer than broad, distal margin with 12 short simple setae; propodus rectangular in shape, around 2.5 times as long as broad, inner face with 10 robust setae. Gnathopod 2 (fig. 4E) similar to gnathopod 1 except propodus over 3 times as long as broad, coxa with eight short setae along margin. Pereopod 4 (fig. 4H) coxa ventral margin not as broadly rounded as in large male.

Uropod 1 (fig. 4J) peduncle similar length to or slightly longer than rami, dorsal margin with up to 10 robust setae along the length of the outer margin and up to five robust setae along the inner margin; outer ramous with distal cluster of five robust setae and one row of six robust setae along length; inner ramous with distal cluster of four robust setae and two rows of robust setae along length, outer margin with three robust setae, inner margin with three robust setae. Uropod 2 (fig. 4I) peduncle dorsal margin with up to four long robust setae; outer ramous slightly smaller than inner ramous, with distal cluster of three robust setae, with one row of four robust setae along length; inner ramous with distal cluster of four robust setae, with two rows of robust setae along length, outer margin with up to five robust setae, inner margin with up to five robust

setae. Uropod 3 (fig. 4F) second article with one short robust seta, and one to two long robust seta apically.

Telson (fig. 4G) longer than broad, apically blunt with pairs long setae apically and laterally.

Oostegites present on coxae 2 to 5 (figs. 4K-N) to form the marsupium, margins with scattered curved hooks.

Variation. Antenna 1: the number of flagellum articles varied from nine to 14 with no clear correlation between sex or body size. Antenna 2: the number of flagellum articles varied from seven to nine with no clear correlation between sex or body size. Despite the differing number of flagellar articles in both antennae, the standard lengths of the two were consistent between sexes and sizes, with antenna 1 1.4-1.6 times as long as antenna 2. It should be noted that Williams (1962) recorded antennal length ratios from 1.4 to 2.0 for *A. australis*. This could reflect sample size differences between this study and Williams' but there may be reason to suspect that cryptic species may have been inadvertently included in his study (see discussion).

Mouthparts are generally well conserved throughout the Chiltoniidae however two of the large male morphotypes, exhibited a reduction in setation on the maxilliped inner plate (from 3 to 2 spine-like setae) (fig. 1E). Both males showing the reduction in setae were at the smaller end of the "large male" morphotype (7.3mm, 7.7mm). Other large males had three setae, along with all the small males and the females (fig. 4C), which is the consistent state across the family. When Williams (1962) described *A. australis* and *A. subtenuis*, he illustrated *A. subtenuis* with two setae on the maxillipedal inner plate but did not further mention it compared to *A. australis* (which he illustrated and described with three setae). This character may be variable within both species.

Remarks. Lowry and Stoddart (2003) accepted Williams' interpretation of *Austrochiltonia australis* and relabelled his invalid type names ("lectoholotype" became the lectotype NMV J11247 and "lectoallotypes" became paralectotype NMV J11248). However, they indicated that NMV J11247 was a male and NMV J11248 was a female, which is incorrect. They also did not refer to the additional paralectotypes identified by Williams.

Both the lectotype male (NMV J11248) and the paralectotype female (NMV J11247) designated by Williams have been damaged over time. Examination of the paralectoypes (NMV J11249) showed better preserved specimens and so the descriptions here have been based on two males (NMV J46778, NMV J46779) and a female (NMV J46780) taken from NMV J11249 and then compared with all existing types to note any variability.

Discussion

The discovery of two separate male morphotypes in the type material was surprising and has never been recorded for amphipods in this family. A similar large male morphotype has been found in samples tentatively identified as *A. subtenuis* (waiting confirmation from type locality specimens) but not in chiltoniid species from mound springs in South Australia (pers. observ.) indicating that this could be some sort of adaptation linked to stream habitats.

One character used by Williams (1962) to define *A. australis* is upheld here: all the animals examined possessed a uropod 3 with two articles. Two other characters Williams used to define *A. australis* were not found here to be informative: the length of antenna 1 vs. the body length and the length of the flagellum in antenna 1 vs. the length of the peduncle. Both were found here to be widely variable across size classes and sexes. *A. australis* can be most easily identified by the presence of a uropod 3 with two articles, a large eye and antenna 1 distinctly longer than antenna 2.

Williams (1962) identified and measured specimens of *A. australis* from Tasmania, Victoria and New South Wales. However, based on the lack of modern taxonomic treatments of these species and the recent discovery of greater chiltoniid species diversity elsewhere in Australia (Murphy et al. 2009; R. King, pers. observ.) it can not be ruled out that similar cryptic diversity exists across Australia. In fact, Williams' (1962) measurements indicated much more variation between antennal lengths than was recorded here in the type material. Without having made a detailed examination of populations from these localities it is difficult to conclude that the specimens that Williams measured from New South Wales and Tasmania are the same species as described here. Therefore the locality of *A. australis* should be restricted to the Yarra River and its tributaries, since the type locality no longer exists, until a sufficient survey can be conducted across Victoria, Tasmania and New South Wales.

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I am grateful to Wolfgang Zeidler for participating in informative discussions on chiltoniid morphology. Many thanks to Gary Poore and Jo Taylor (Museum Victoria) for arranging the loan of the type material. This work was funded by an Australian Biological Resources Study (ABRS) National Taxonomy Research Grant (No. 208-61).

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New and poorly described stenothoids (Crustacea, Amphipoda) from the Pacific Ocean.

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Abstract

Krapp-Schickel, T. 2009. New and poorly described stenothoids (Crustacea, Amphipoda) from the Pacific Ocean. *Memoirs of Museum Victoria* 66: 95–116.

Nine stenothoid species were found during different Danish expeditions to the Pacific Ocean at the end of the 19th and beginning of the 20th century. They belong to the genera *Stenothoe* (two new species and one probably new for the Central Pacific) and *Metopa* (three new species and three probably already known).

Keywords

Stenothoidae, taxonomy, Pacific Ocean, *Stenothoe garpoorea* n.sp., *Stenothoe verrucosa* n.sp., *Stenothoe* cf. *miersii*, *Metopa eupraxiae* n.sp., *Metopa exigua* n.sp., *Metopa torbeni* n.sp., *Metopa koreana*, *Metopa* cf. *bulychevae*, *Metopa* cf. *clypeata*

Introduction

Many years ago Torben Wolff encouraged me to look at a small collection of Pacific stenothoid amphipods from the end of the 19th or begin of 20th century, stored at the Copenhagen Museum. I agreed with pleasure and interest, but soon understood that size as well as number of specimens was very small, and preferred to wait for additional material from similar localities, which never happened. When I now present them here, still some species cannot be fully described, as the material was scarce, appendages missing etc. But there is little knowledge about this group in the area concerned, thus every new contribution should be a step further.

Material and methods

The habitus of the amphipods was studied in alcohol or glycerine under a Reichert dissecting microscope and slides were prepared using Faure‘s medium. Body parts were drawn with pencil (and sometimes photographed, for offering as much additional information as possible) using an Olympus BX51 or Wild M5 microscope, both with a camera lucida. The inking of the pencil drawings I did partially the traditional way, partly I used the Illustrator program (see Coleman 2003, 2009). Acronyms for different morphological parts are as follows: **A1, 2** = antenna 1, 2; **Gn1, 2** = gnathopod 1, 2; **Mx1, 2** = maxilla 1, 2; **P3-7** = peraeopod 3–7; **T**= telson; **U1–3** = uropod 1–3. Species‘ diagnosis is provided in **bold** text within the description. Species examined are lodged at the Copenhagen Museum (ZMUC).

Taxonomy

Genus *Stenothoe* Dana, 1852

Diagnosis. Palp of mandible absent. Palp of maxilla 1 with 2 articles. Inner plate of maxilla 2 often reduced and outer plate sitting more or less upon the inner one. Inner plates of maxilliped well separated. Gnathopod 1 small, subchelate, propodus expanded, palm oblique and subequal to remaining hind margin of propodus, carpus shorter than propodus. Peraeopod 5 with rectolinear basis, peraeopod 6–7 with expanded basis. Telson entire, flappable.

Stenothoe garpoorea n.sp.

Figs. 1, 2

Holotype: male 2.5mm; from „Danske Expedition til Kei Oerne" by T. Mortensen, 1922; 15m sand and *Acanthogorgia*; slide ZMUC CRU-20183.

Type locality: Kai (or Kei) Islands (= Nuhu Evav, Tanat Evav), E-Banda-Sea, SE Indonesia, province Maluku (see also Mortensen, 1923).

Additional material: female, same locality, slide ZMUC CRU-20184.

Etymology: In 1997 and 2001 Gary Poore gave me the opportunity to work at the Victoria Museum in Melbourne and „take a dip" in the rich amphipod collection there which primarily was built up by him personally. The present species is named after a combination of his first and family name, used as an adjective.

Description. Based on male, 2.5 mm.

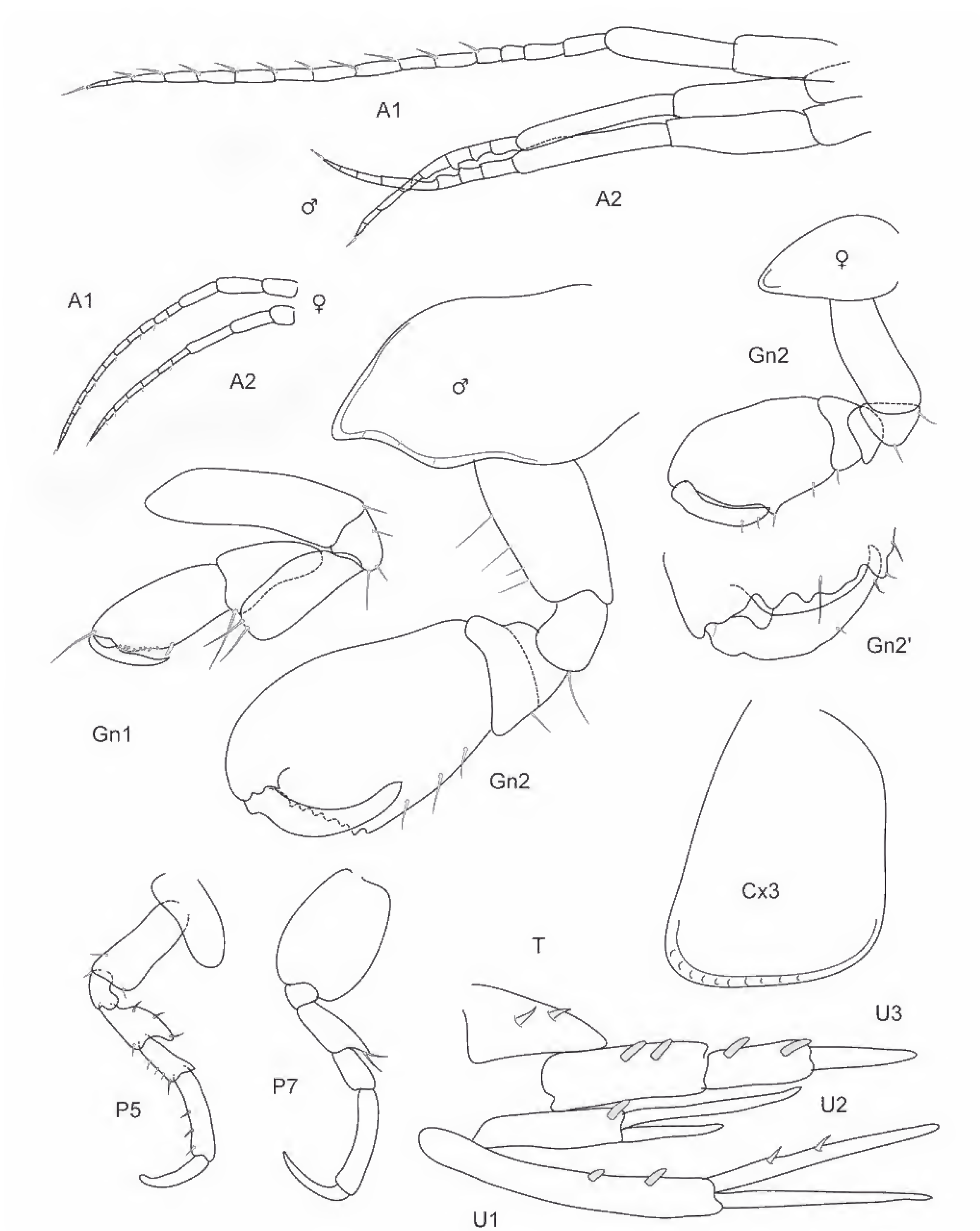

Figure 1: *Stenothoe garpoorea* n.sp.: holotype male 2.5 mm and paratype female 2.2mm, SE Indonesia.

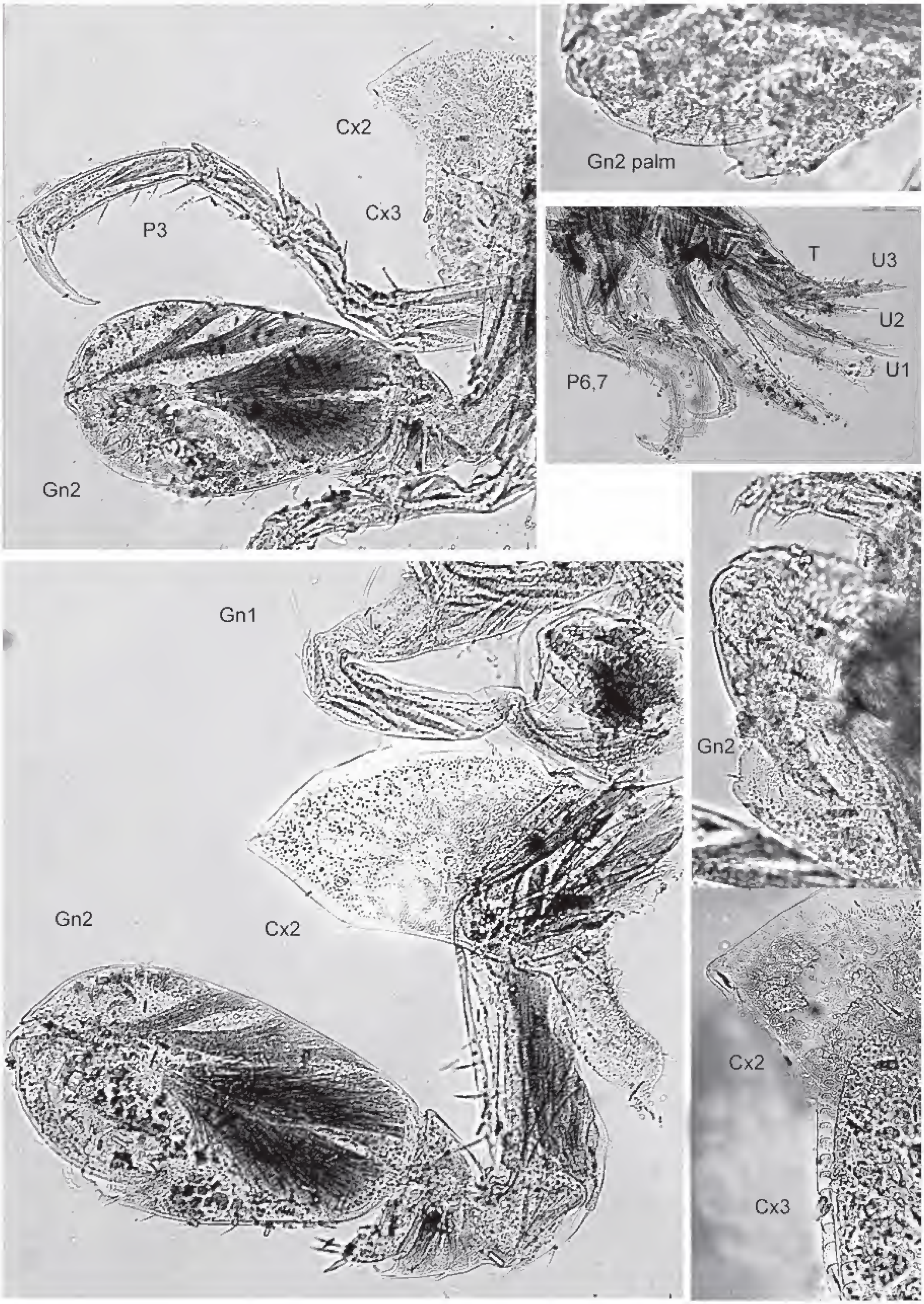

Figure 2: *Stenothoe garpoorea* n.sp.: holotype male 2.5 mm, SE Indonesia.

Head. *Eyes* rather big, round. *Antenna 1* longer than head and peraeonites 1–4, longer than antenna 2; peduncular article 2 longer than article 1; flagellum with 14 articles; accessory flagellum absent or not found. ***Antenna 2*** peduncle article 4 subequal or somewhat shorter than article 5, a bit thicker; **flagellum with 8 articles which have each a hump distally next to the articulation and only on one side**; obviously these second antennae are used to grip or hold on the host, as they are always kept symmetrically with these humps showing to the antenna of the other side.

Mouthparts. *Mandible* palp absent (at least not found). *Maxilla 1* palp 2–articulate. *Maxilliped* outer plate minute.

Peraeon. *Gnathopods 1–2* dissimilar in size and shape. *Gnathopod 1* subchelate; merus enlarged, produced distally, longer than carpus; carpus triangular, longer than wide; propodus about 2 x as long as broad, palm defined by obtuse corner. ***Coxa 2* triangular, distally with acute corner.** ***Gnathopod 2*** subchelate, carpus shorter than wide, cup-shaped; **propodus distally widened, similar to a fist, palm unevenly serrated**; dactylus reaching about half length of propodus. ***Coxa 3* distally with stridulation ridge.** *Peraeopod 5* basis not expanded, but linear, merus widened and distally also slightly lengthened, reaching about 1/3 along carpus. *Peraeopod 6, 7* basis fully expanded; merus distal expansion reaching about 1/3 length of carpus; dactylus large, subequal or larger than half propodus).

Pleon. *Epimeron 3* posteroventral corner subquadrate/ rounded. *Urosomites* free. *Uropod 1* peduncle without distoventral spine, subequal rami shorter than peduncle. ***Uropods 2* inner rami clearly shorter than outer ones. *Uropod 3* with peduncle and single ramus, which is longer than peduncle, 2 articulate, article 2 subequal in length to article 1; peduncle and ramus article 1 each with 2 robust setae.** *Telson* laminar, with 2 dorsolateral robust setae, apically subacute.

Female (sexually dimorphic characters). A1 relatively shorter. *Gnathopod 2* palm less serrated than in male, Cx2 narrower.

Habitat. Marine; among the gorgonacean *Acanthogorgia*. On sand, 15 m.

Distribution: Indonesia, Pacific Ocean.

Remarks. This species shares the very unusual and characteristic humps or „warts“ on the second antennae with *Stenothoe verrucosa* n.sp., which was found in the same habitat; but in the latter these humps are on the last peduncular and first flagellum article, while in the present species they are exclusively on the flagellum. No other members of this genus are reported with such a structure.

Stenothoe verrucosa n.sp.

Figs. 3, 4

Holotype: male 3.5mm; from „Danske Expedition til Kei Oerne" by T. Mortensen, 1922; 15m sand and *Acanthogorgia*; slide ZMUC CRU-20185.

Type locality: Kai (or Kei) Islands (= Nuhu Evav, Tanat Evav), E-Banda-Sea, SE Indonesia, province Maluku (see also Mortensen, 1923).

Etymology: „Warty“ is in Latin „verrucosus“; used as an adjective, indicating the very special structure of the second antenna.

Description. Based on male, 3.5 mm.

Head. *Eyes* normal size, roundish. *Antenna 1* longer than head and peraeonites 1–4, longer than antenna 2; peduncular article 2 longer than article 1; flagellum with 22 articles; accessory flagellum absent. ***Antenna 2*** peduncle article 4 shorter than article 5 and thicker; **article 5 with 5 humps or „warts“ on the inner margin**; **flagellum article 1 thickened proximally and distally next to the articulations on the inner side**; obviously these second antennae are used to grip or hold on the host, as they are always kept symmetrically with these humps showing to the antenna of the other side.

Mouthparts. *Mandible* palp absent, molar absent. *Maxilla 1* palp 2–articulate. *Maxilliped* inner plate reaching along 1/3 of ischium, outer plate absent.

Peraeon. *Gnathopods 1–2* dissimilar in size and shape. *Gnathopod 1* subchelate; merus very much enlarged, produced distally, surpassing carpus; carpus triangular, much longer than wide, more than 2x as long as wide; propodus about 2x as long as broad, medially widened, palm defined by obtuse corner. ***Coxa 2* anterior margin rounded, posterior one straight, distally with rounded corner. *Gnathopod 2*** subchelate, carpus shorter than wide, cup-shaped; **propodus distally narrowing, palm with 4–5 small humps, no palmar corner**; **dactylus reaching along full length of propodus, inner margin beset with many short setae**. ***Coxa 3* distally with stridulation ridge, posterior margin excavated.** *Peraeopod 5* basis linear, merus widened and distally also shortly lengthened, reaching about 1/2 along carpus. *P 6, 7* basis fully expanded; merus distal expansion reaching about 1/2 length of carpus; dactylus subequal to half propodus.

Pleon. *Epimeron 3* posteroventral corner subquadrate/ rounded. *Urosomites* free. *Uropod 1* peduncle without distoventral spine, beset with many short robust setae; subequal rami shorter than peduncle. ***U 2* inner rami somewhat shorter than outer ones. *U 3* with peduncle and single ramus, which is shorter than peduncle, 2 articulate, article 2 shorter than article 1; ramus article 1 each with 1 robust seta.** *Telson* laminar, with 2 dorsolateral robust setae, apically subacute.

Female unknown.

Habitat. Marine; among the gorgonacean *Acanthogorgia*. On sand, 15 m.

Distribution: Indonesia, Pacific Ocean.

Remarks. This species shares the very unusual and characteristic humps or „warts“ on the second antennae with *Stenothoe garpoorea* n.sp., which was found in the same habitat; but in the latter these humps are not on the last peduncular and first flagellum article, but exclusively on the flagellum.

Stenothoe cf. *miersii* (Haswell, 1879)

Figs. 5, 6

Montagua Miersii Haswell, 1879: 323, pl. 24, fig. 4
Montagua longicornis Haswell, 1879: 323, pl. 24, fig. 5

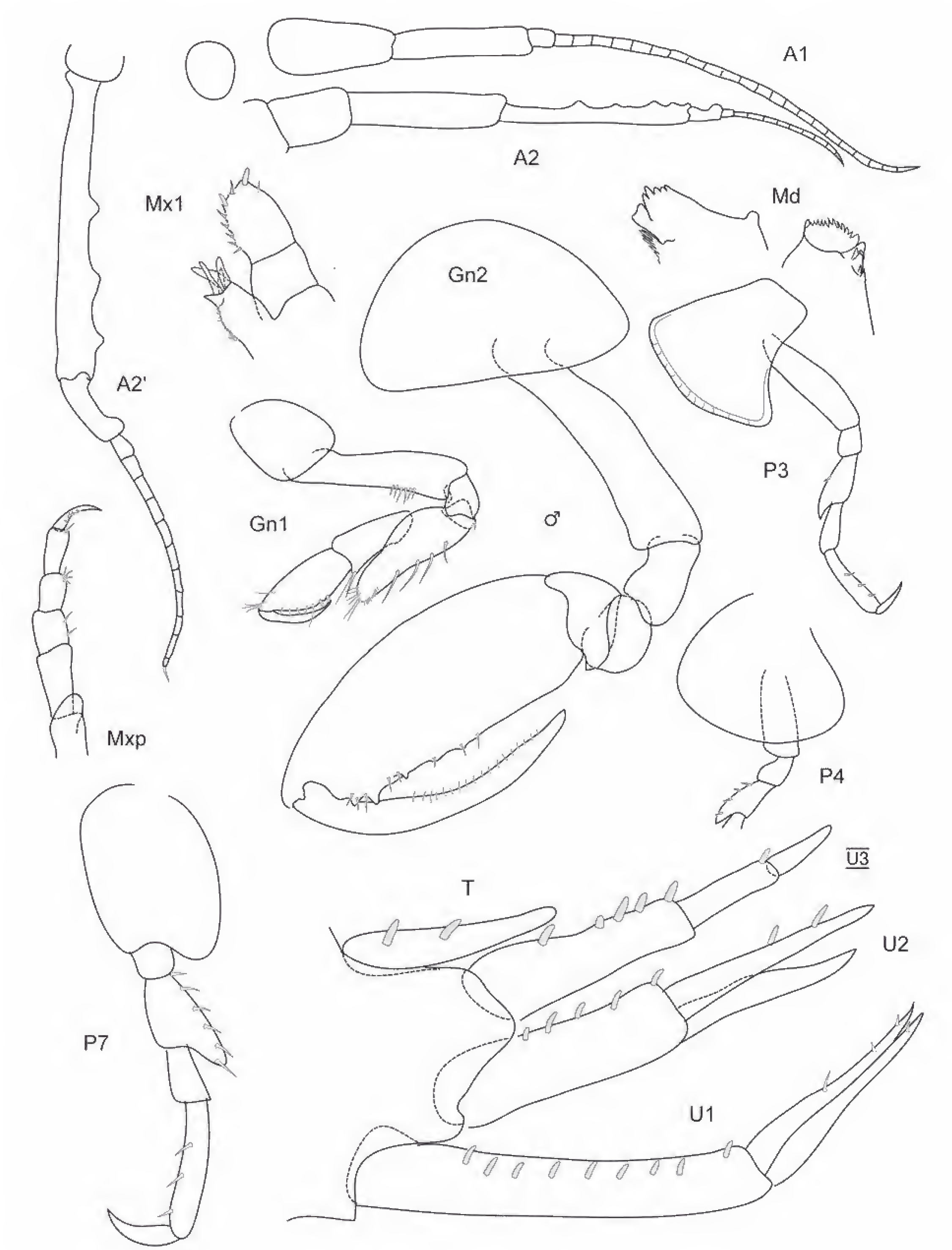

Figure 3: *Stenothoe verrucosa* n.sp.: holotype male 3.5mm, SE Indonesia.

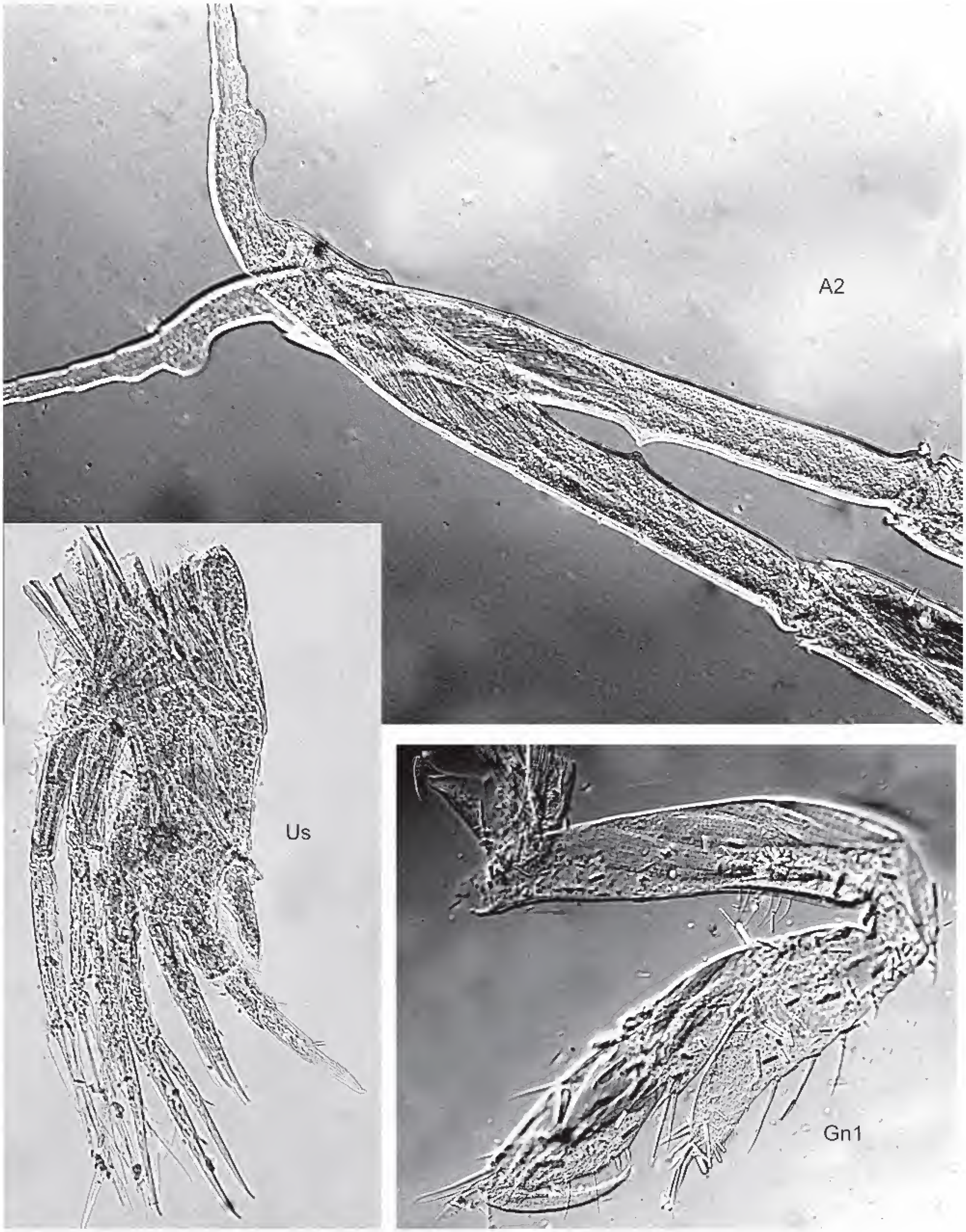

Figure 4: *Stenothoe verrucosa* n.sp.: holotype male 3.5mm, SE Indonesia.

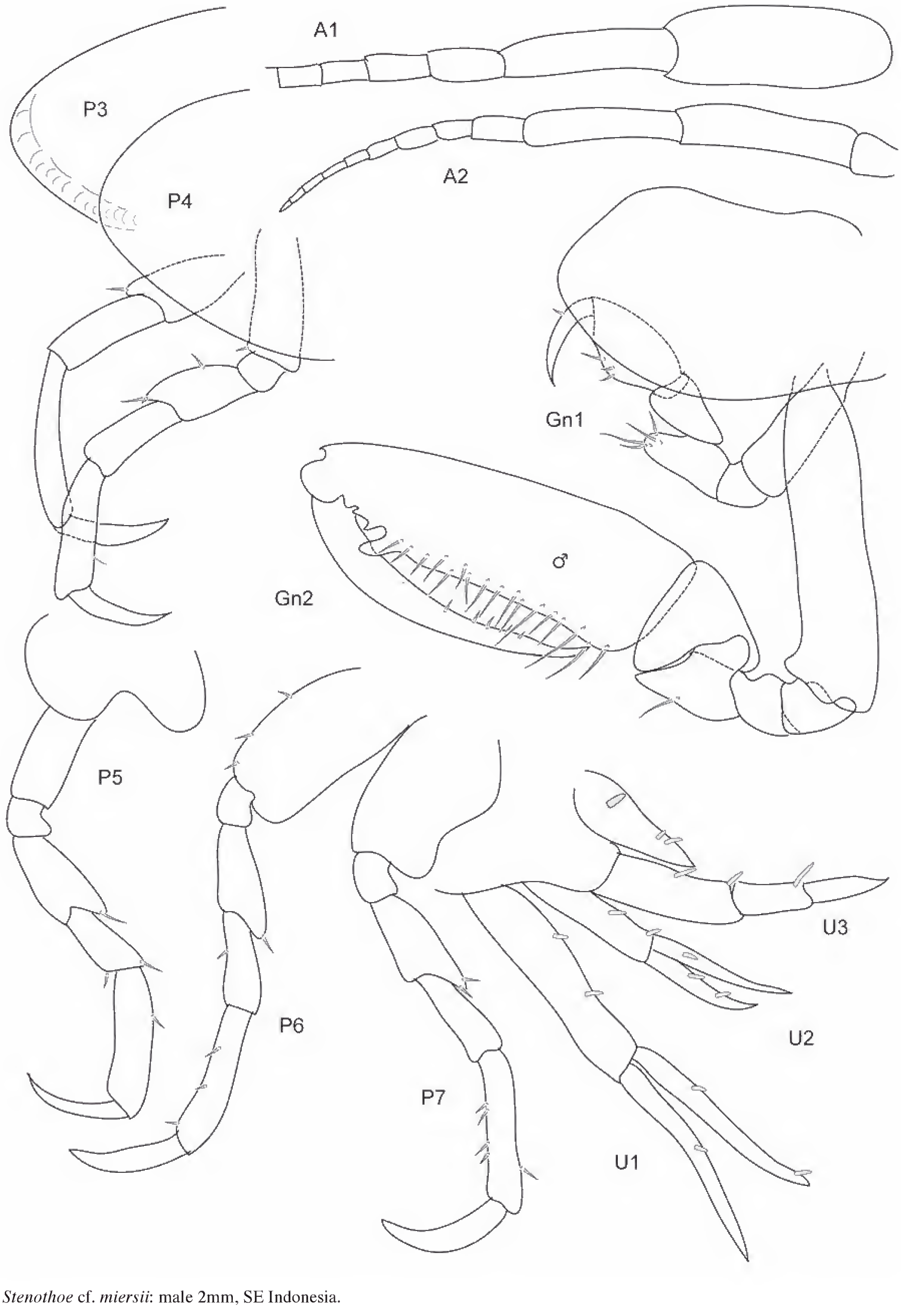

Figure 5: *Stenothoe* cf. *miersii*: male 2mm, SE Indonesia.

Figure 6: *Stenothoe* cf. *miersii*: male 2mm, SE Indonesia.

Material examined: male 2mm from „Danske Expedition til Kei Oerne" by T. Mortensen, 1922 (SE Indonesia); 15m sand and *Acanthogorgia*; slide ZMUC CRU-20186.

Remarks. There are several characters which fit perfectly to *Stenothoe miersii* (antennae, gnathopods, coxalplates, peraeopods), but the characteristic peduncular spur on U1 is only minutely developed, and the basis of P6 and P7 is not fully expanded. *Stenothoe miersii* is reported with a length of 3.5mm in fully adult specimens and the present single specimen measures only 2mm, thus both these characters could change with allometry. Until now it was reported around most of the Australian coasts; it would be new for Indonesia.

Genus *Metopa* Boeck, 1871

Diagnosis. Palp of mandible with 3–2 articles. Palp of maxilla 1 with 1 article. Inner plate of maxilla 2 ordinary. Inner plates of maxilliped often fused or well separated (type). Gnathopod 1 small, almost simple, but variable, propodus scarcely expanded, almost linear, carpus elongate. Peraeopod 5 with rectolinear basis, peraeopod 6–7 with expanded basis. Telson entire, flappable.

Metopa eupraxiae n.sp.

Figs. 7–9

Stenothoides carinatus Gurjanova 1953: 230–233, figs. 13, 14

Stenula carinata (Gurjanova) in: Barnard & Karaman 1991: 69 (change of genus for the illustration of the Md palp without articulation)

non *Metopa carinata* Hansen 1887:311 = *Metopella carinata* in Gurjanova 1951: 474, figs. 311

Holotype: Tsugaru Strait = Tsugaru-kaikyo (41° 37'N, 140° 52'E), N-Japan, between Japan Sea and Pacific Ocean, on hydroid *Sertularia crassicornis* Allman, coll. Suensen 1882, 200m depth; 1 male 4mm (18) slide ZMUC CRU-20187.

Additional material: same locality, same collector, 1 female slide ZMUC CRU-20188; 38 specimen (males, females, juveniles) in alcohol. 2 adult specimens 4mm in alcohol, coll. Suensen 1882 and 1893 ZMUC CRU-20201 & CRU-20202, 2 slides ZMUC CRU-20189 & CRU-20190; 2 specimens in alcohol, probably juveniles. ZMUC CRU-20203.

Etymology: In honour to Eupraxia Gurjanova.

Description. Based on male, 4 mm

Body. Posterior half carinate.

Head. Eyes rounded. *Antenna 1* peduncle robust, article 1 length about three times the width; flagellum 18 articles, accessory flagellum absent. ***A 2* clearly longer than A1**, peduncle robust, flagellum shorter than peduncle, with 14 articles.

Mouthparts. ***Mandible*** palp clearly visible with one rectangular basal article and a long second one which is more than 3x longer than article 1, with 3 distal and some marginal long setae; the **usual article 3 is missing**. *Maxilla 1* palp with 1 article; *Maxilla 2* plates in ordinary tandem position; *Maxilliped* IP not fused, about 2/3 length of ischium; OP visible as acute tooth-shaped prolongation; dactylus long, subequal to propodus.

Peraeon. *Coxae. Cx2* oval without tooth; *Cx3* tongue-shaped, 2.5x longer than wide, *Cx4* not excavated, anterior margin straight, posterior margin rounded, about 1.5 x wider than long.

Gnathopods. Gn1, 2 propodi extremely different in shape and size. ***Gnathopod 1* propodus rectangular, palm oblique, well defined, remaining hind margin longer than palm; carpus clearly longer than propodus, with parallel margins, proximally somewhat narrower than distally; merus incipiently chelate, with free distal end;** all articles beset with groups of long setae. ***Gnathopod 2*** length of propodus subequal to longer than Cx2; **propodus trapezoid-shaped, rectipalmate; anterior margin beset with robust setae;** hind margin subequal to length of palm which has one deep excavation near thumb-shaped palmar corner and 5 humps next to dactylus insertion; incisions between these humps have long setae which get lost with age; dactylus same length like palm. **Gn2 carpus much shorter than wide, cup-shaped, merus not lobate.**

Peraeopods. ***P3*** **basis elongate but proximally swollen, with glands inside**; anterior margin regularly beset with many short setae; all other articles elongate and weak, dactylus longer than half propodus, weak and smooth; all articles except basis have short setae on posterior margin. *P4* all articles much more robust, but without setation; merus anterodistal margin lengthened and rounded; **dactylus on inner side strongly serrated like in P5–7. *P5–P7* merus about twice as wide as carpus** and only about 1.25% lengthened posterodistally, reaching ca the proximal third of carpuslength; basis P6, 7 widened with rounded posterodistal lobe.

Pleon. *Uropods. U1* peduncle shorter than subequal rami, with short robust setae on peduncle and rami; *U2* peduncle also beset with small robust setae, shorter than longer ramus, rami very unequal (about 3:2); ***U3*** **peduncle much shorter than ramus, article 1 of ramus subequal to peduncle and much longer than the claw-shaped robust article 2.**

Telson. Not reaching end of peduncle U3, with 3 robust setae on each side.

Habitat. On hydroids, 200m depth.

Distribution. Tsugaru Strait, between the Japan Sea and Pacific Ocean.

Remarks. Gurjanova, 1953 described a new species *Stenothoides carinatus* from the Kuril Islands East of Japan, between the Kamchatka Peninsula and the Japanese Hokkaido. Two years later she published another new species from a similar locality, *Metopa kobjakovae*. These two species differ mainly in the presence/absence of a third article in the mandibular palp, the length of U3 ramus article 1 and the spination of the telson with presence/absence of robust setae also on the upper surface.

The present material is very close to *Stenothoides carinatus* Gurjanova 1953, which was later given to *Stenula* by Barnard & Karaman, 1991 for the Md palp drawn without any articulation. But in the present specimens there is clearly visible a proximal first article on the Md palp, and furthermore the gnathopods are indicating a close relationship to *Metopa*, not to *Stenula*.

As the name *Metopa carinata* is already occupied, although in synonymy with other taxa, there had to be created

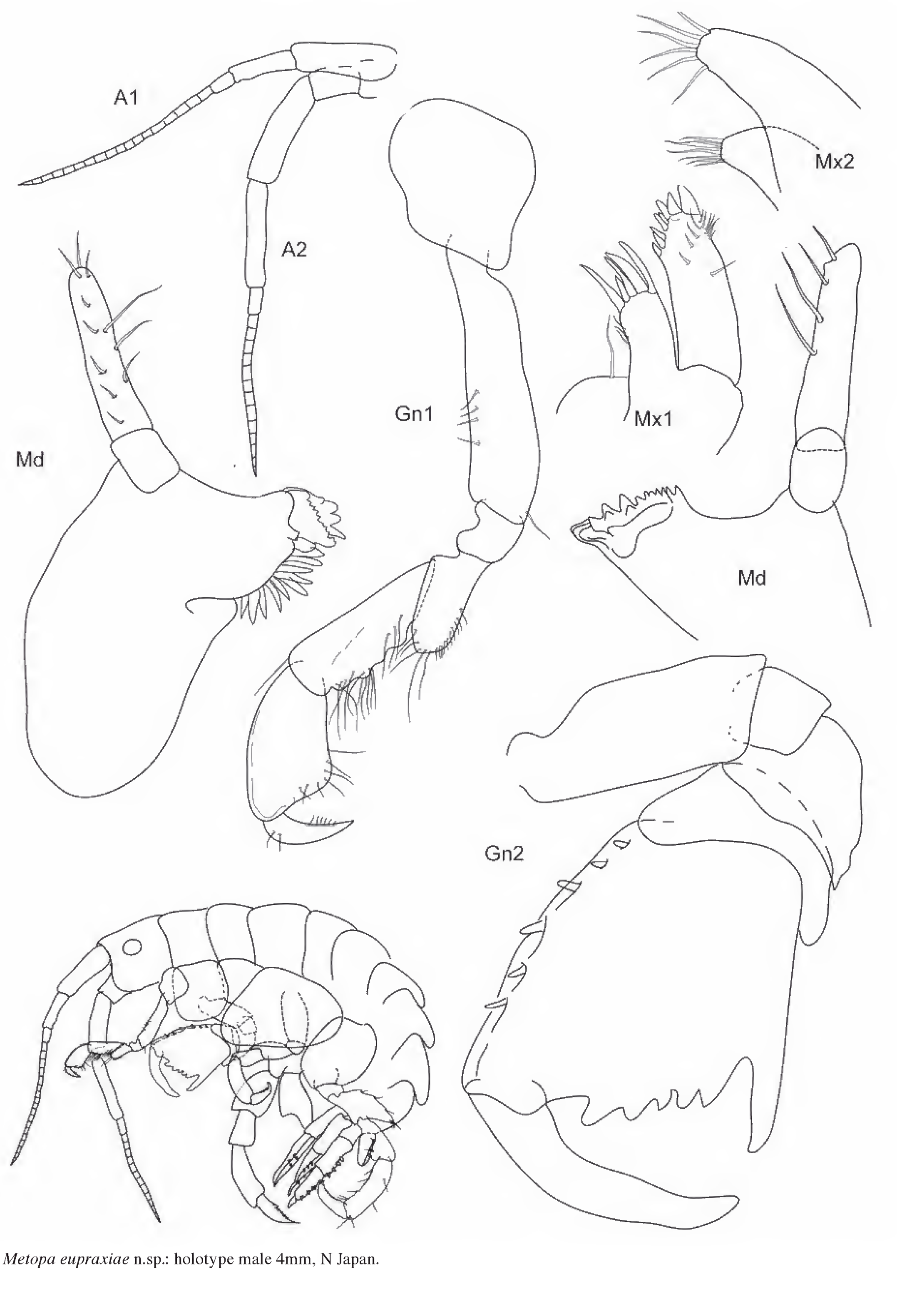

Figure 7: *Metopa eupraxiae* n.sp.: holotype male 4mm, N Japan.

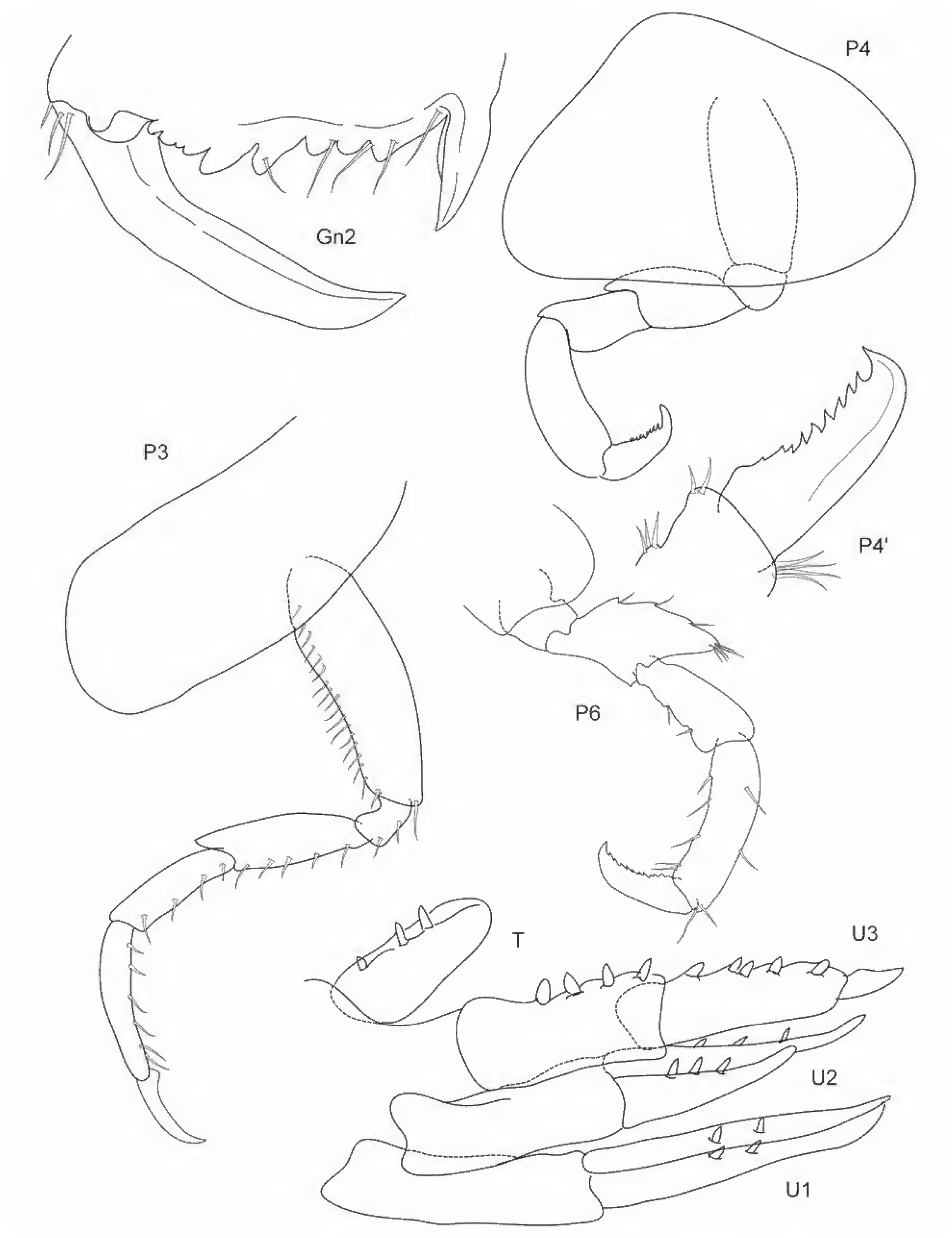

Figure 8: *Metopa eupraxiae* n.sp.: holotype male 4mm, N Japan.

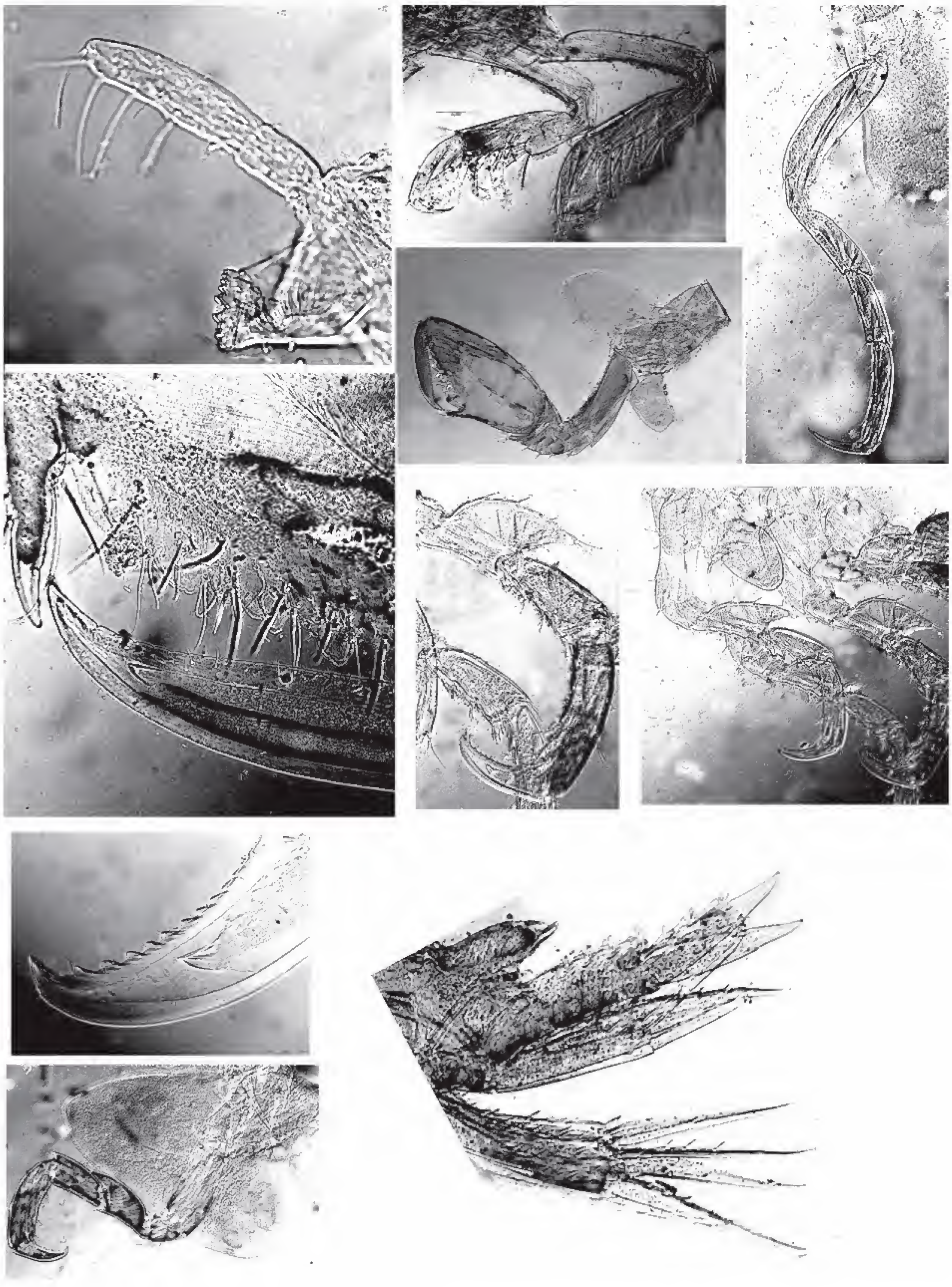

Figure 9: *Metopa eupraxiae* n.sp.: holotype male 4mm, N Japan.

a new name for this species. It matches well the drawings of Gurjanova, 1953 for *Stenothoides carinatus* except:

- Gn1 propodus palmar corner a bit wider than 90° (in Gurjanova exactly 90°)
- the shorter merus on P4–7 in our material,
- the not illustrated serration of the dactyli in P4–7 (clearly present in our material)
- the spination in U3 and T (richer in Gurjanova's species).

The differences from our material to *Metopa kobjakovae* are:

- Md palp with 3 articles
- Gn1 propodus palmar corner a bit wider than 90° (in Gurjanova exactly 90°)
- U3 ramus article longer
- T richly spinose
- nowhere mentioned a carinate body in *M. kobjakovae*, while the serration on P6, 7 is illustrated.

It could be that all three species are synonymous and show allometric differences, in this case the new species presented here would become junior synynym of *Metopa kobjakovae*; but for the time being I cannot check if *M. kobjakovae* also has a carinate body and if older specimens of the other species become more richly spinose.

Metopa exigua n.sp.

Figs. 10–11

Holotype: one male 2mm. Off Korea, 38°15'N, 128°45'E, 200m depth, coll. Schönau IV/1897. Slide ZMUC CRU-20191.

Additional material: 2 females ov. 1.8mm same locality. Slides ZMUC CRU-20192.

Type locality: off Korea.

Etymology: from Latin „exiguus" meaning poor, weak, tiny, minute.

Description. Based on male 2mm, female 1.8mm

Body. Smooth.

Head. Eyes rounded. ***Antenna 1*** peduncle article 1 length about three times the width in female, in male slimmer; **article 2 in female shorter, in male much longer than article 1**; flagellum 13–14 articles, accessory flagellum absent. *A 2* clearly shorter than A1, peduncle article 4 the longest, flagellum shorter than peduncle, with 6–10 articles.

Mouthparts. ***Mandible* palp with one quadrangular basal article and a long, thickened second one which is more than 3x longer than article 1, and a very short and small third article carrying 1 long distal seta.** *Maxilla 1* palp with 1 article; *Maxilla 2* plates in ordinary tandem position; *Maxilliped* IP not fused; OP visible as acute tooth-shaped prolongation; dactylus long, shorter than propodus.

Peraeon. *Coxae. Cx2* oval without tooth; *Cx3* tongue-shaped to rectangular, *Cx4* not excavated, anterior margin straight, posterior one rounded.

Gnathopods. Gn1, 2 propodi extremely different in shape and size. ***Gnathopod 1* propodus rectangular and narrow, palm not defined; carpus clearly longer and wider than propodus, proximally narrower than distally; merus without free distal end;** all articles beset with groups of short setae. ***Gnathopod 2* male propodus hind margin longer than length of palm which has one deep rounded excavation near thumb-shaped palmar corner and many small serrations next to dactylus insertion;** these incisions show single setae; dactylus somewhat shorter than length of palm. **Gn2 carpus longer than wide, triangular, merus not lobate.**

Peraeopods. ***P3* basis elongate and slender; all other articles elongate and weak, dactylus longer than half propodus, weak and smooth**. ***P4* all articles much more robust, with dense setation; merus somewhat curved;** dactylus longer than half propodus. ***P5–P7* merus wider than carpus and only shortly lengthened posterodistally;** basis P6, 7 widened with rounded posterodistal lobe; all peraeopods with short setation.

Pleon. *Uropods. U1* peduncle longer than subequal rami, with short robust setae on peduncle and rami; ***U2* peduncle also beset with small robust setae, longer than longer ramus, rami very unequal; *U3* peduncle shorter to subequal ramus, article 1 of ramus shorter or subequal to the spine-shaped robust article 2.**

Telson. Triangular, distally pointed, with few marginal robust setae.

Habitat. 200m depth.

Distribution. Off Korea, Pacific Ocean.

Remarks. At first sight this species looks similar to *Metopa wiesei* Gurjanova, 1933, as the second male gnathopod is nearly identical.

For a better comparison I provide here a detailed translation of the original description of the latter species:

„*Metopa wiesei* Gurjanova 1933: 123; 1951; 421 fig. 260

Type locality: Jugorsky Shar, 69° 46'N, 60°35'O, 20m depth.

Translation of original description in Gurjanova 1933:

Length 3.5mm. Eyes large, roundish. Antennae long; A1 article 1 as long as 2+3 together; flagellum 13 articles. A2 somewhat longer than A1, peduncle article 3 > article 2; flagellum short, 7 articles. Mxp inner plate not fused; last articles of palp with short stiff setae on inner margin and basis. Mx1 palp with 1 article, Md palp with 2 articles.

Cx 4 evenly rounded, very large. Peraeopods robust. P6,7 basis short, broad, merus broadened and lengthened.

Gn1 simple, dactylus on inner margin with short setae. Gn2 in male strongly developed with a long acute tooth on palmar corner; palm with 5 rounded humps which are stronger versus outer margin. Ep3 with acutely lengthened posterodistal corner. T oval, with acute tip and 3 pairs of thick dorsal robust setae. U3 peduncle with 3 thick robust setae, ramus articles subequal, but shorter than peduncle.

Stands near to *Metopa clypeata*, but Ep3, eyes, antennae, both gnathopods and telson shape are different."

This description, without any illustrations in Gurjanova 1933, but with some sketchy ones in Gurjanova 1951, makes clear that mainly the antennae (A1 article1 as long as article 2+3 together) and peraeopods (merus broadened and lengthened) are very different from the newly coined species. It seems also probable that *M. wiesei* has a more robust body living in 20m depth, while *M. exigua* n.sp. has the thin and delicate legs of

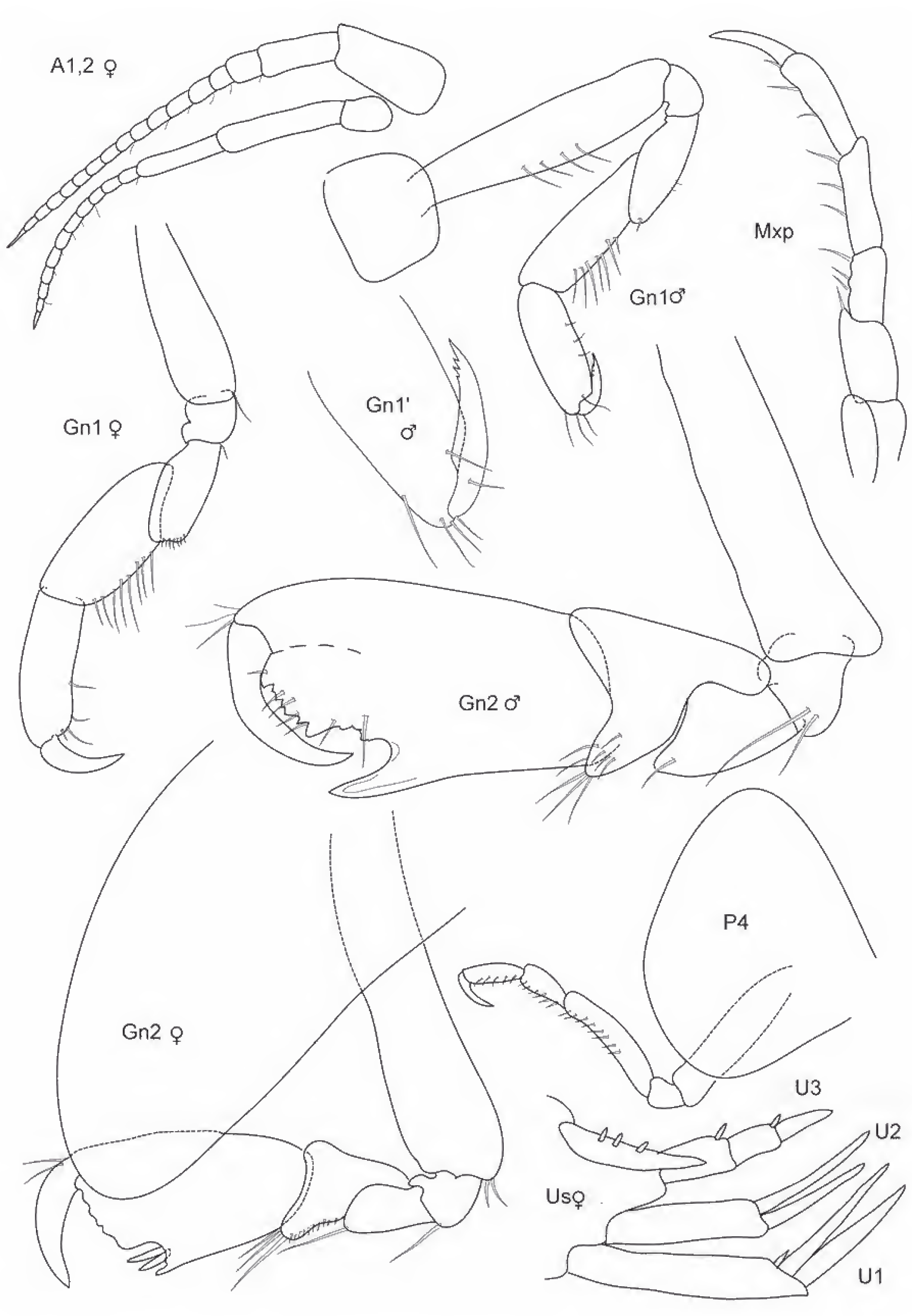

Figure 10: *Metopa exigua* n.sp.: holotype male 2mm, female 1.8mm, off Korea.

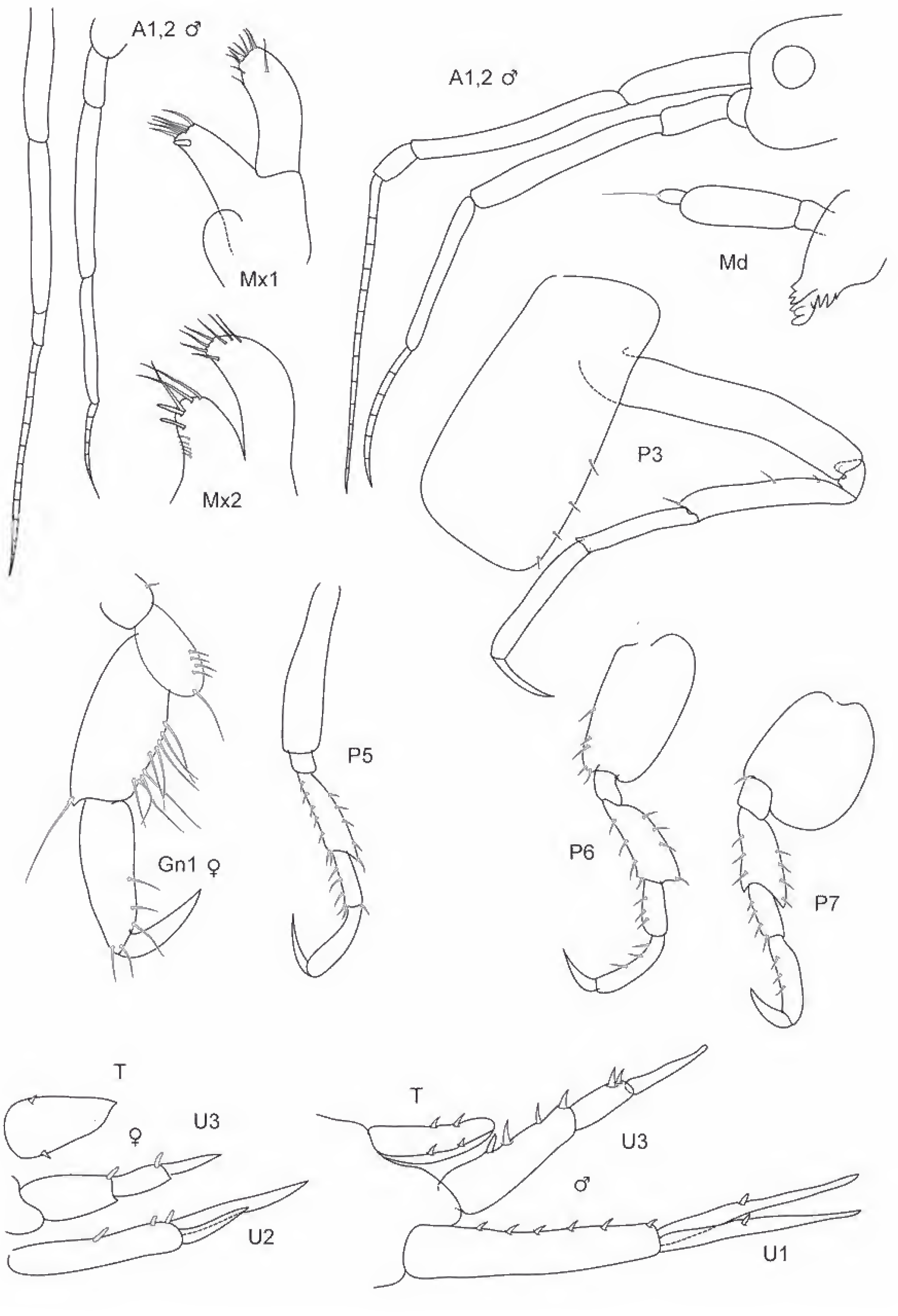

Figure 11: *Metopa exigua* n.sp.: holotype male 2mm, female 1.8mm, off Korea.

typical mud inhabitants (it comes from 200m depth).

The new species belongs to a difficult group with often not very clear morphological character-states: *Metopa abyssi* Pirlot, 1933*; M. angustimana* Gurjanova, 1948*; M. bruzelii* (Goes, 1866); *M. dawsoni* Barnard, 1962; *M. longicornis* Boeck, 1871; *M. longirama* Dunbar, 1942; *M. palmata* Sars, 1895; *M. quadrangula* Reibisch, 1905; *M. tenuimana* Sars, 1895*; M. wiesei* Gurjanova, 1933.

They all share the simple Gn1 with elongate propodus and carpus, which are similarly wide (vs. carpus much wider in the group around the type species *M. clypeata*) and should be separated from the other members of *Metopa*. It should also be checked, if all of them have the inner plates of the maxilliped well separated like the type *M. clypeata* and unlike many other *Metopa* members.

Metopa torbeni n.sp.

Fig. 12

Holotype: 1 spec. ?sex 3mm. Danish Exp. to Siam by Carl Mortensen, Gulf of Thailand, 1.6 km S of Ko(h) Chuen, shells; dredge; 1. February 1900; 30 Fv. = 54m; slide ZMUC CRU-20193.

Type locality: Gulf of Thailand.

Etymology: Dedicated to the 90th birthday of Torben Wolff, indefatigable crustaceologist at the Copenhagen Museum.

Description. Based on ?sex, 3mm.

Head. Eyes rounded. *Antenna 1* robust, longer than head and peraeonites 1–4, longer than antenna 2; peduncular article 1 length about two times the width; flagellum with 14 articles; accessory flagellum absent. *A2* much shorter than A1, peduncle robust, flagellum longer than peduncle article 5, with 8 articles.

Mouthparts. Mandible palp not clearly seen, with one long distal seta. *Maxilla 1* palp 1–articulate. *Maxilla 2* outer plate sitting next to inner one. *Maxilliped* inner plates not fused, surpassing length of ischium, rectangular; outer plate lacking, dactylus a bit shorter than propodus.

Peraeon. *Coxa* 2 oval without tooth; *Cx3* tongue-shaped; *Cx4* not excavated, anterior and posterior margin rounded, much wider than long. *Gnathopods 1–2* extremely dissimilar in shape and size. ***Gnathopod 1* dactylus short and thickened; propodus elongate, palm not defined, about 4 x as long as wide; carpus much longer than propodus, also with parallel margins, proximally wider than distally; merus incipiently chelate, with free obtuse distal end; all articles beset with groups of setae. *Gnathopod 2* length of propodus longer than Cx2, subpiriform; hind margin much shorter than length of palm which has one wide shallow excavation near palmar corner and 4 humps next to dactylus insertion; palmar corner not well defined. Dactylus same length like palm; carpus shorter than wide, cup-shaped, merus not lobate.** *Peraeopod 4* merus anterodistal margin somewhat lengthened. *Peraeopod 7* basis widened with rounded posterodistal lobe; merus lengthened and widened, reaching about 3/4 carpus length.

Pleon. *Urosomites* articulation not clearly visible. *Uropod 1* peduncle nearly twice as long as subequal rami, with 5 short robust setae; *U 2* peduncle also beset with small robust setae, longer than longer ramus, rami unequal; *U 3* peduncle longer than ramus, article 1 of ramus longer than article 2.

Telson. Not reaching end of peduncle U3, with 2 robust setae.

Female (sexually dimorphic characters). Unknown.

Habitat. Marine; among shells, 54m.

Distribution: Gulf of Thailand, Pacific Ocean.

Remarks. Despite the fact that the mandible palp of this small specimen was not clearly visible, this new species must belong to the group around the type of *Metopa*, having a very specialized Gn1 with a short dactylus, narrow propodus, elongate carpus distally narrowing and a short rectangular merus with a free distal margin. However, Gn2 propodus is different from all other members, as *M. clypeata* (Krøyer, 1842); *M. cristata* Gurjanova, 1955; *M. kobjakovae* Gurjanova, 1955; *M. koreana* Gurjanova 1952; *M. leptocarpa* Sars, 1883; *M. norvegica* (Liljeborg, 1851), *M. robusta* Sars, 1895; *M. spitzbergensis* Brüggen, 1907; *M. submajuscula* Gurjanova, 1948: all have a clearly pronounced tooth on the palmar corner, and most of these species are rectipalmate. Even if the present specimen is a young one, it is quite improbable that allometric growth will change the propodus to such a degree.

Metopa koreana Gurjanova 1952

Figs. 13–14

M. koreana Gurjanova 1952: 187–188, fig. 13

Material examined:

•off Korea, 42°N, 130' E; 1100m; 2.1.1901. Beautiful and rich material in alcohol (more than 30 males, females, juveniles). (27). ZMUC CRU-20198.

•36°45'N, 130°E 1.12.1934 6mm slide, 2 spec. in alcohol (51); „E-Asia", Suensen leg., 19. 4. 1911: 1 specimen 6mm (22). ZMUC CRU-20194.

Length: 6–8mm

Remarks. There are only a few characters different to the very similar, but nearly twice as long type species *Metopa clypeata* (Krøyer) from the Atlantic: in the type the Gn2 is clearly rectipalmate and the palm seems nearly smooth, while the present material has a palmar corner of about 120° and in males there are two semicircular excavations near the palmar corner, whereas the females or juveniles have only shallow excavations; Gn2 carpus is dorsally similarly but somewhat less sculptured in *M. koreana*; Cx2 has an unusual blunt corner of about 120° on the hind margin (vs. linguiform rounded Cx2 in *M. clypeata*); Gn1 carpus is a bit stronger and more prominent in *M. clypeata*; A2 peduncle article 4 and article 5 are subequal and very long (vs. much more robust and shorter). P5–7 merus is less lengthened distoposteriorly, the legs are more slender. The differences which are most easily seen are in the usorome: U1,2 peduncle is clearly longer than the rami (vs. peduncle and rami subequal in *M. c.*, see Tandberg & Vader 2009 Fig. 8), U3 has a long, slender peduncle with many robust setae (vs. a characteristical prolongation on the peduncle with few robust setae in *M. clypeata)*, T with many robust setae (vs. with few robust setae in *M. c.*, see also Tandberg & Vader 2009 figs. 8, 9).

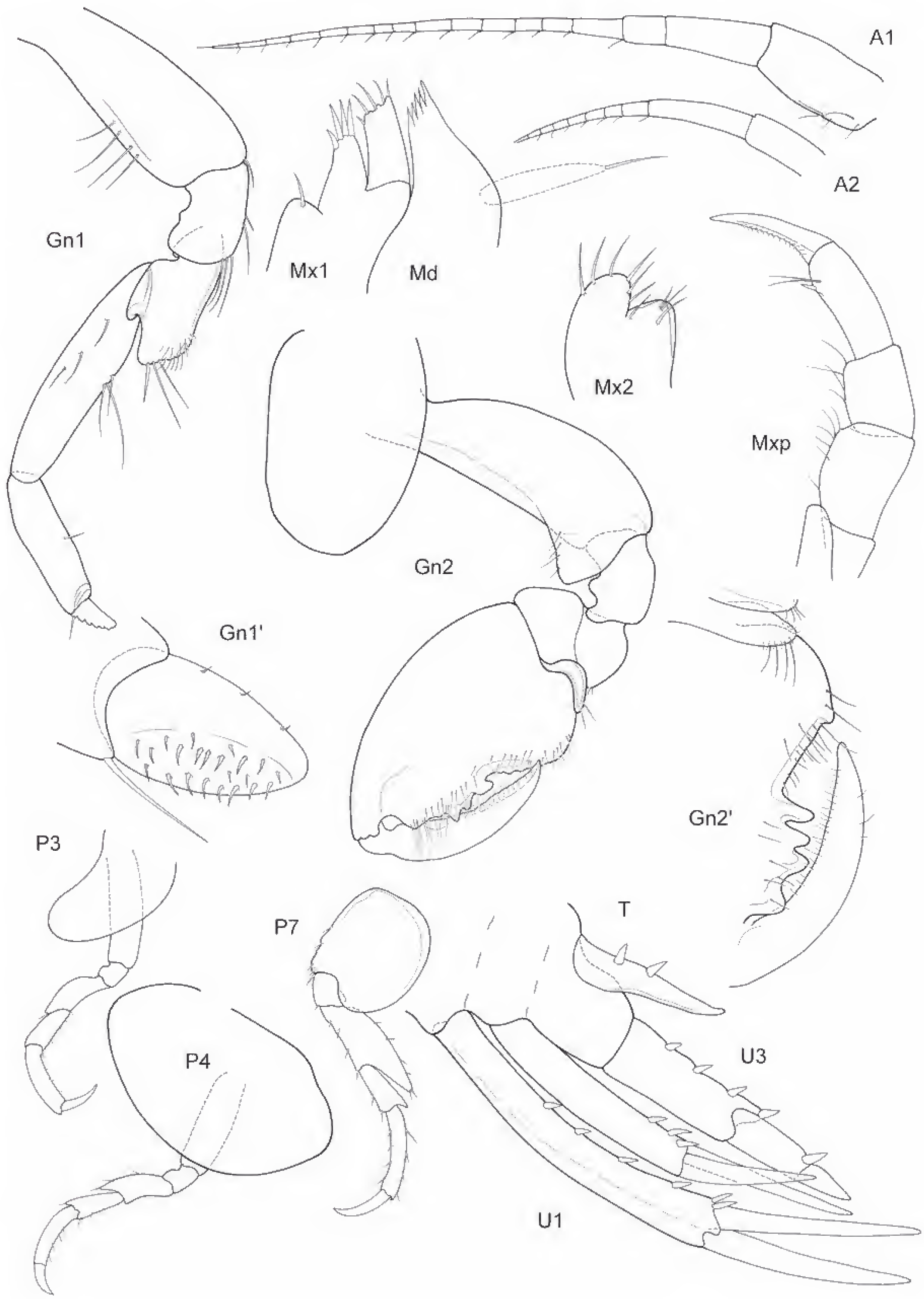

Figure 12: *Metopa torbeni* n.sp.: holotype ?sex 3mm, Gulf of Thailand.

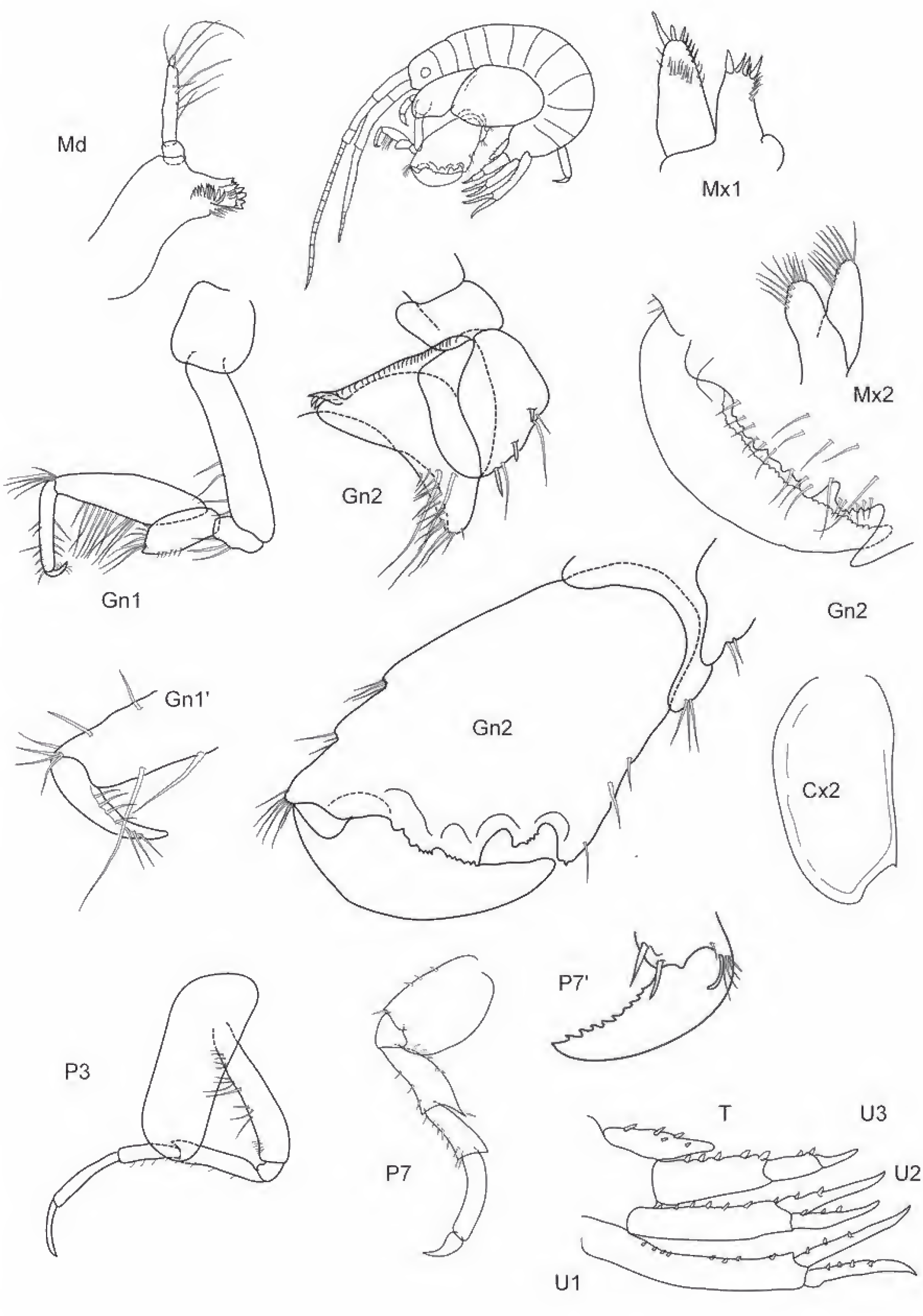

Figure 13: *Metopa koreana*: male 6mm, off Korea.

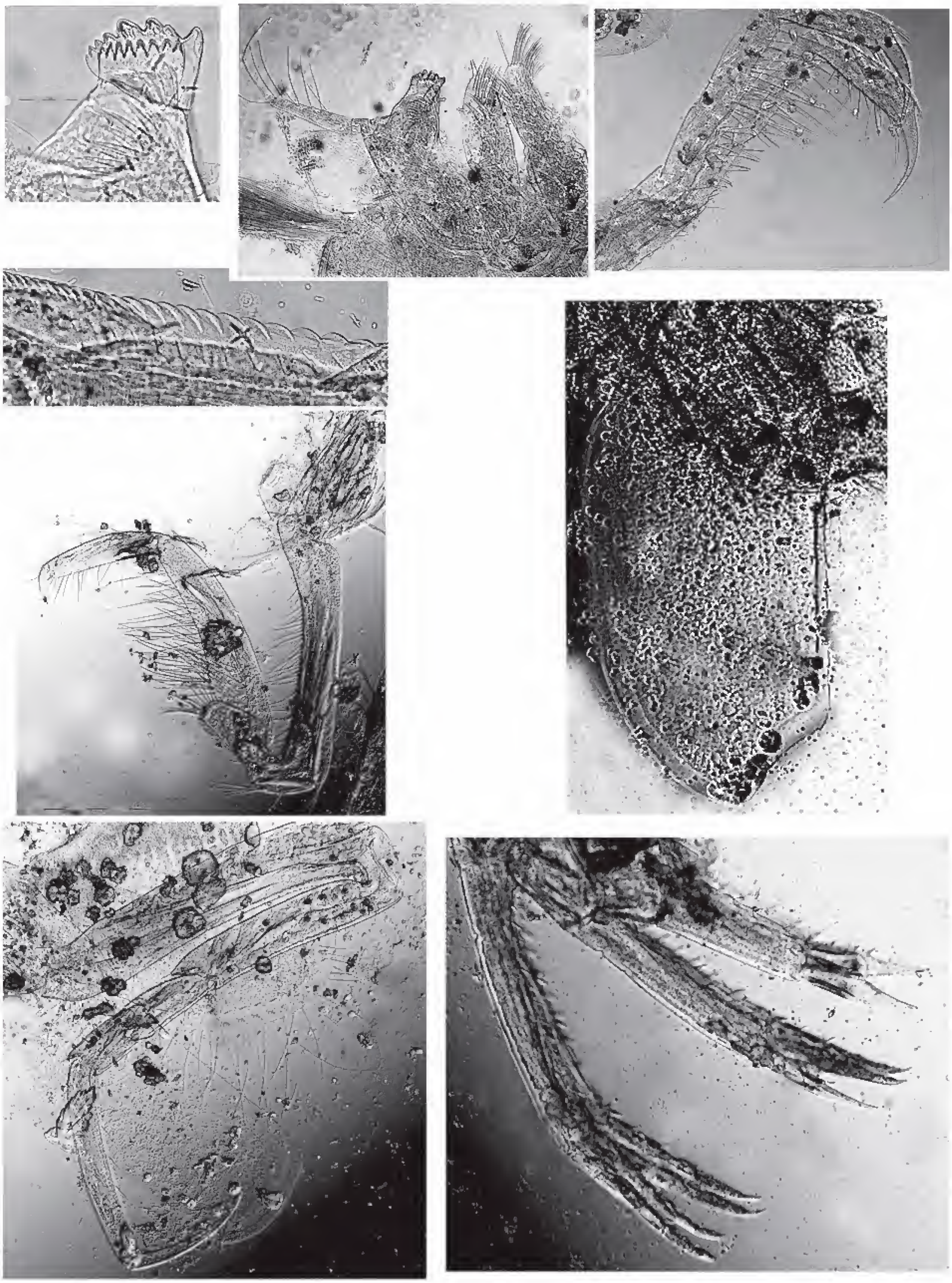

Figure 14: *Metopa koreana*: male 6mm, off Korea.

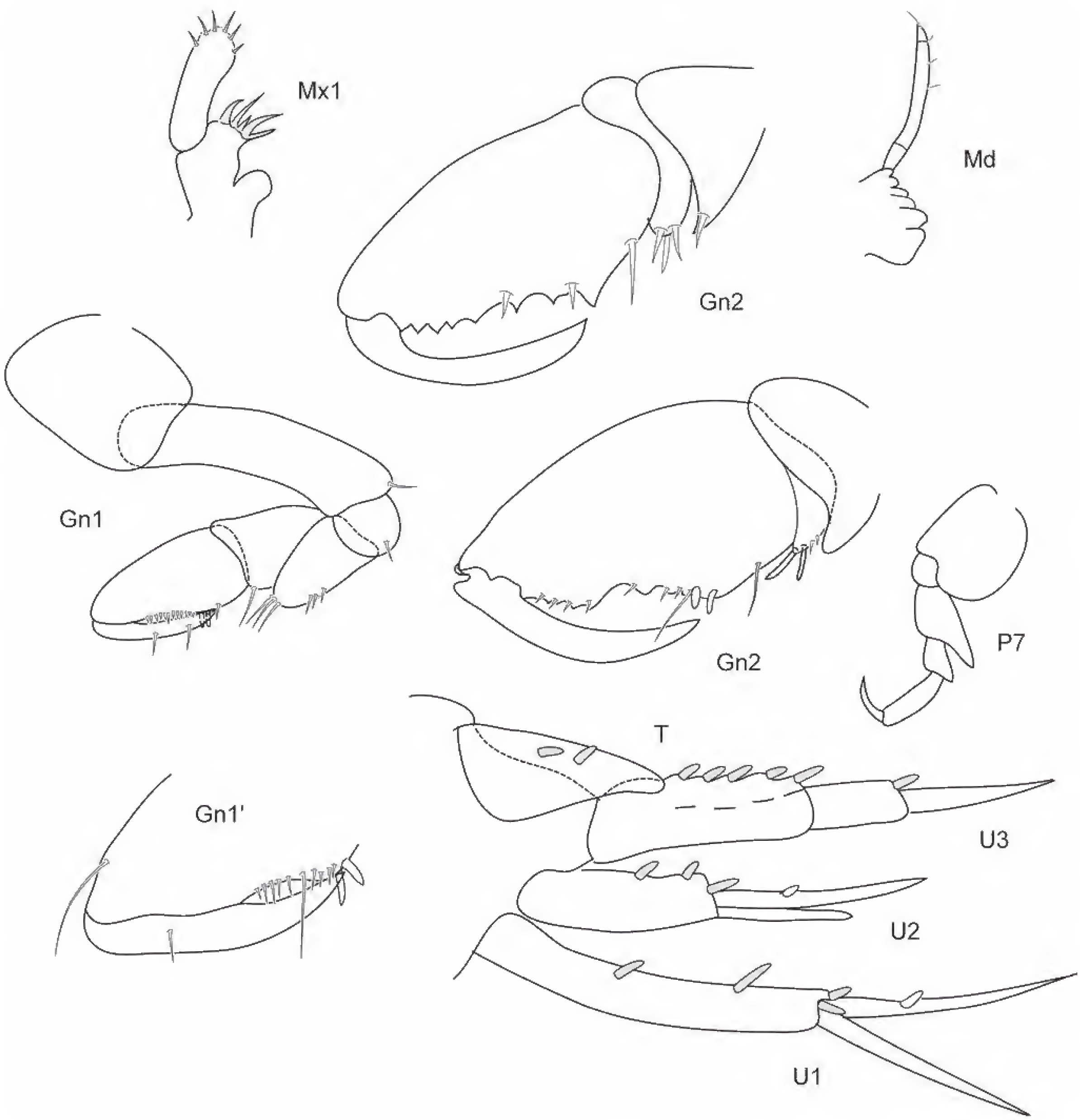

Figure 15: *Metopa* cf. *bulychevae*: ?juv. 1.5mm, Chinese coast.

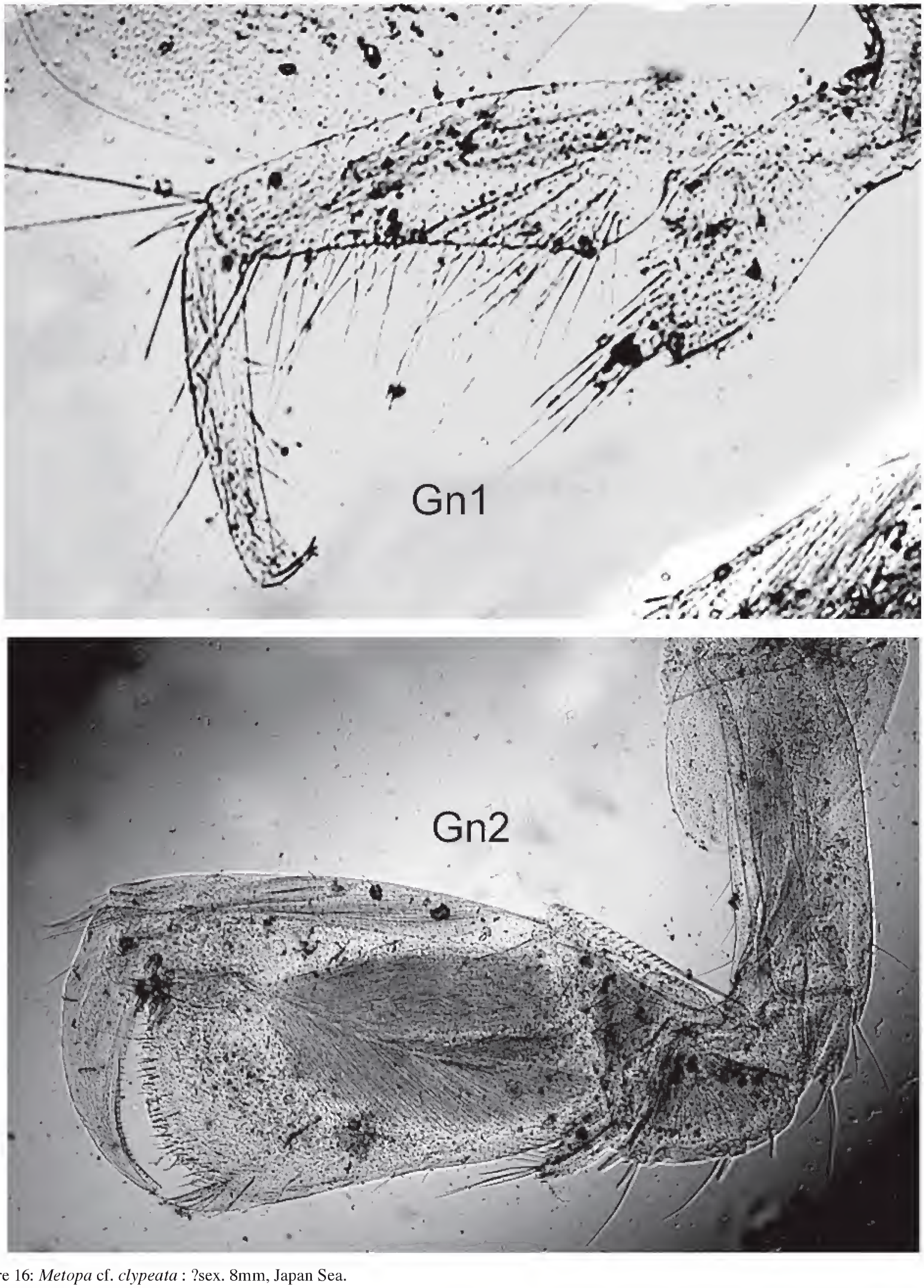

Figure 16: *Metopa* cf. *clypeata* : ?sex. 8mm, Japan Sea.

***Metopa* cf. *bulychevae* Gurjanova, 1955**

Fig. 15

Metopa bulychevae Gurjanova 1955: 170–172, figs. 3, 4

Material examined: Small (juv.?) specimen (1.5 mm) in not very good condition, from 23°20'N, 118°30'E (coast of China) and 17 Fr depth, slide ZMUC CRU-20195.

Remarks. There is a (probably basic) group of *Metopa* species with a first gnathopod having a widened propodus which shows a palmar corner: the Atlantic species *M. aequicornis* Sars, 1879, *M. alderi* (Bate, 1857), *M. boeckii* Sars, 1895 belong here, as well as *M. spectabilis* Sars 1879, if it is not a synonym to *M. alderi*; but also the Pacific species *M. samsiluna* Barnard, 1966 and the Japanese ones, *M. uschakovi* Gurjanova, 1948 and *M. bulychevae* Gurjanova, 1955. Both are not completely described, but *Metopa uschakovi* has a Gn1 which is much more slender with a carpus much longer than broad, and in U3 the peduncle is less spinose, while the characters of gnathopods, P7 and U3 would fit quite well to *M. bulychevae.*

***Metopa* cf. *clypeata* (Krøyer, 1842)**

Fig. 16

Leucothoe clypeata Krøyer 1842:157; 1845: 545 pl. 6, fig. 2a–f
Metopa clypeata Tandberg & Vader 2009: 3 figs. 1–9, 19–21 (see here for elaborate synonymy)

Material examined:
•42°N, 130° 30'E (Japan Sea), 16. 11.1881 Suensen coll., 8mm 1 es. alcohol. 1 slide, ZMUC CRU-20196.
•30° 50'N, 122° 40'E Japan, Nagasaki, Gutzloff & Schönau coll.: 21 specimens 6mm, 1 ad. 12mm. ZMUC CRU-20197.

Remarks. It seems strange that the Atlantic species *M. clypeata* is found also on the Northern Pacific Coasts, but morphologically there is absolutely no difference to the meticulously redescribed type in Tandberg & Vader, 2009. As already mentioned in *M. koreana*, *M. clypeata* can become quite large (up to 15mm), has a more or less smooth, only shallowly waved or finely serrated palm on Gn2 in both sexes with a 90° palmar corner, and robust, poorly spinose uropods and telson.

Gurjanova 1951:417 describes the species as follows:

„A1 longer than A2, Gn1 straight, article 4 expanded with wide hilly lobe, article 5 elongate and widening in the middle, distally narrowing, article 6 narrow, linear, shorter than article 5. Dactylus with 7–8 setae on ventral margin.

Gn2 with strong subchela; on surface of cup-shaped article 5 rows of small glistening humps, article 6 very big, 2x as long as article 5; distally somewhat widened. Palmar margin nearly horizontal with large tooth-shaped prolongation, in males near this tooth a deep sinus. In all peraeopods the inner margin of the dactylus with teeth.

U3 basal article with 5–6 short robust setae, 2 rami equal to length of outer margin of basal article (= peduncle).

Telson with 2 pairs of lateral spines. Length up to 12mm.

Geographical distribution: amphiboreal, known from western and eastern Groenland, Spitzbergen, bay of St. Lawrence, lives in hydroid colonies. Tschukots Sea, Bering, Ochotks, Japanese Sea. Data of Jsrzhinskij (1870) from the White Sea until now not confirmed.“

This species is not very commonly found, and at sites far apart: Tandberg & Vader 2009: Greenland (type locality), Bering Sea, Point Barrow, Alaska, Gulf of St. Lawrence in depths from 20 to 300m; older reports from Bohuslän (Sweden), Banff (Scotland), Christiansund (W-Norway) and Tromsø (N-Norway). Now also from the Pacific Ocean?.

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The genus *Floresorchestia* (Amphipoda: Talitridae) on Cocos (Keeling) and Christmas Islands

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Abstract

Lowry, J.K. & Springthorpe, R.T. 2009. The genus *Floresorchestia* (Amphipoda: Talitridae) on Cocos (Keeling) and Christmas Islands. *Memoirs of Museum Victoria* 66: 117–127.

The widespread Indo-West Pacific and Caribbean talitrid genus *Floresorchestia* is reported from Cocos (Keeling) and Christmas Islands for the first time and a new species, *F. poorei* is described. *Floresorchestia poorei* is common on the beaches of West Island, Cocos (Keeling).

Keywords

Crustacea, Amphipoda, Talitridae, Cocos (Keeling) Islands, Christmas Island, taxonomy, new species, *Floresorchestia poorei*

Introduction

As part of the Circum-Australian Amphipod Project (CAAP) a team of Australian Museum biologists collected extensively at Cocos (Keeling) Islands and Christmas Island during October 2008. Among the collections was a new species of *Floresorchestia* from sheltered sand beaches at Cocos (Keeling) Islands. A small population of *Floresorchestia* was also found at Dolly Beach on Christmas Island but no mature males were collected and we cannot describe it at this time. There are few other beaches on Christmas Island with suitable habitat. At the time of its collection the population was small, sheltering under coconuts and restricted to the edges of a small stream in the middle of Dolly beach.

Floresorchestia is a widespread coastal and forest-dwelling genus which occurs mainly on islands in the Indian and Pacific Oceans and in the Caribbean Sea. It is a straightforward genus to recognize because of the autapomorphic stridulating organs on the epimera. Unfortunately early species such as *F. pickeringi* (Dana, 1853), *F. floresiana* (Weber, 1892), *F. anomala* (Chevreux, 1901) and F. *ancheidos* (K.H. Barnard, 1916) were not well described in a modern sense and this has lead to confusion in later identifications. Recently Miyamoto & Morino (2008) have produced modern detailed descriptions which reveal newly recognised species-level characters in the genus. In this paper we describe a new species, *F. poorei* from Cocos (Keeling) Islands and report an undescribed population of *Floresorchestia* from Christmas Island.

We think there are unrecognized species hidden in the synonymies of *F. anomala* and *F. floresiana*. We also suspect there are additional undiscovered species scattered throughout the numerous Indo-West Pacific islands. This is an important area of investigation because this widespread Indo-West Pacific and Caribbean genus, with little means of dispersal, holds an important biogeography story.

Location

Cocos (Keeling) is an isolated atoll in the north-eastern Indian Ocean. Until the 1840's it was forested and was the site of a huge seabird rookery. In the early 1800s the habitat was destroyed and replaced with Coconut trees. The only remaining intact habitat in this set of islands is at North Keeling Island about 20 km north of Cocos (Keeling). The islands of Cocos (Keeling) are ringed by white calcareous sand beaches. *Floresorchestia poorei* is common in the supralittoral zone on these beaches wherever suitable habitat occurs. We strongly suspect *Floresorchestia poorei* was living at Cocos (Keeling) before the transformation, but there is a possibility that it was introduced with the Coconut plantations. If they were there before the transformation then they should be living on North Keeling Island.

Micro-morphology of Floresorchestia

The maxillipedal palp in talitrids may be fully developed, reduced to a small rectangular article, reduced to a button-shaped article or fused to article 3 of the palp. In *Floresorchestia poorei* it is reduced into a button-shaped article (fig. 1C).

The male gnathopod 1 and female gnathopod 2 have well developed lobes on the posterior margin of the merus, carpus and propodus (figs 1D, H, J, 2D). These lobes are covered in short palmate setae (fig. 2E, F) of Oshel & Steele (1988: 96, fig. 16). Palmate setae have a solid base radiating into short distal tines and may be used in rasping or scouring. They take

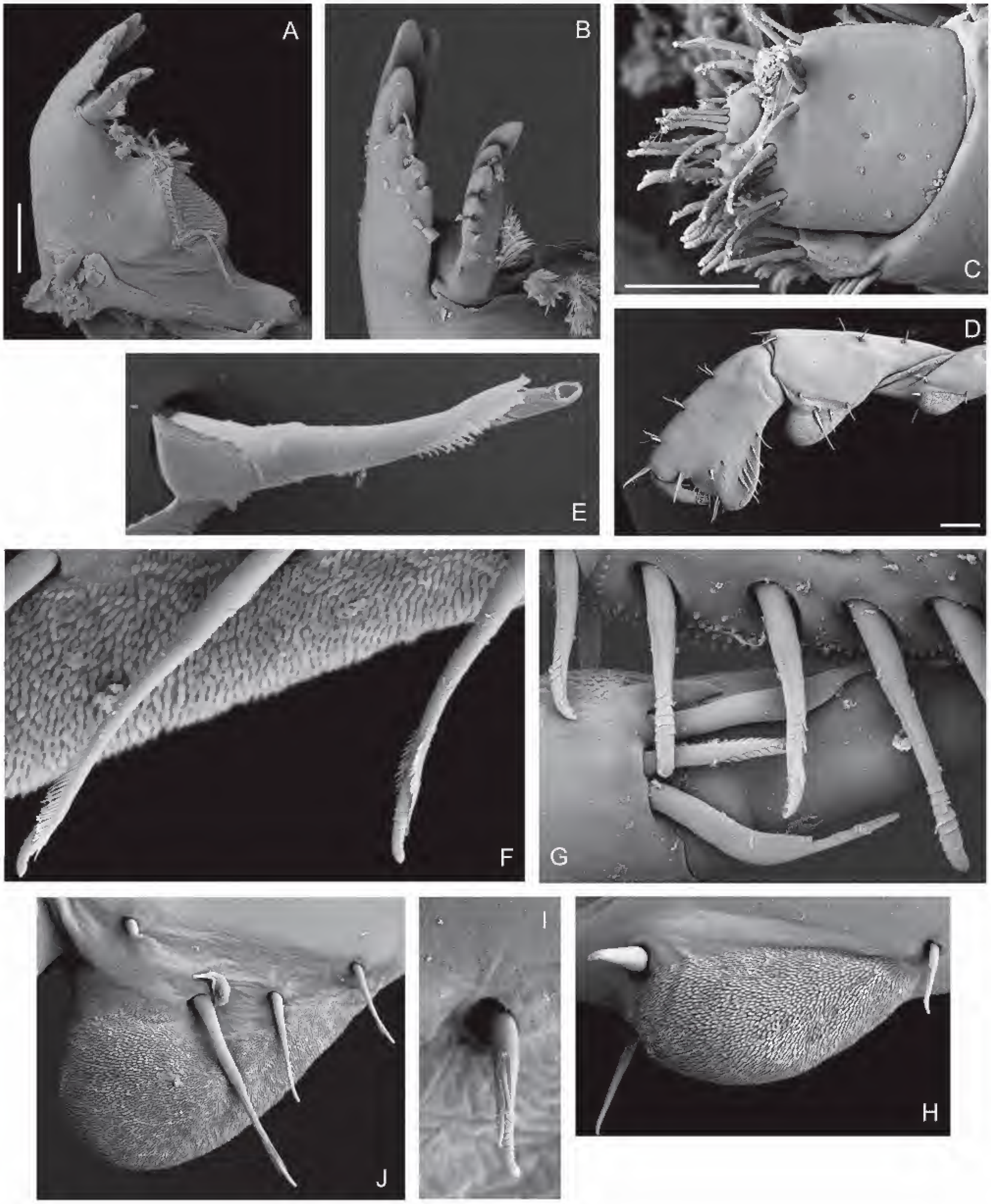

Figure 1. *Floresorchestia poorei* sp. nov., A–B, paratype, female, AM P80543: left mandible; B, left mandible incisor; C, paratype, female, AM P80543: maxilliped palp article 4. D–J, paratype, male, AM P80544: male gnathopod 1; E, propodus posterolateral serrate seta; F, propodus posterolateral serrate setae; G, palm and dactylus showing cuspidate setae along palm; H, merus showing posterior lobe covered in palmate setae; I, propodus lateral cuspidate seta; J, carpus showing posterior lobe covered in palmate setae. Scale bars: A, B and D represent 100 μm, C represents 50 μm.

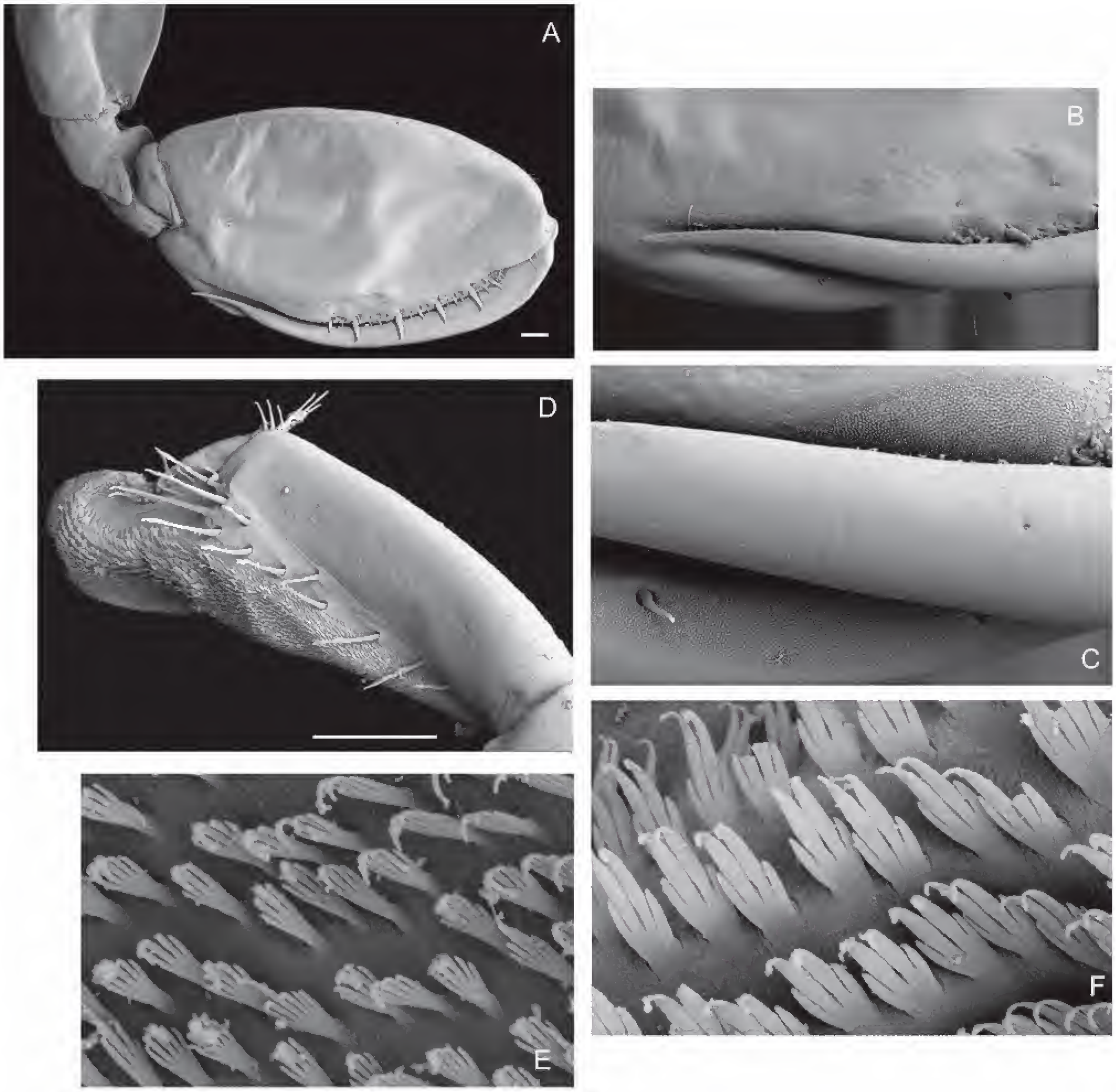

Figure 2. *Floresorchestia poorei* sp. nov., A–C, gnathopod 2, paratype, male, AM P80544: B, posteromedial margin of palm showing attenuated dactylus fitting into groove with cuticular patch; C, cuticular patch. D–F, gnathopod 2, paratype, female, AM P80543: E, small palmate setae on propodus; F, large palmate setae on propodus. Scale bars: A and D represent 100 μm.

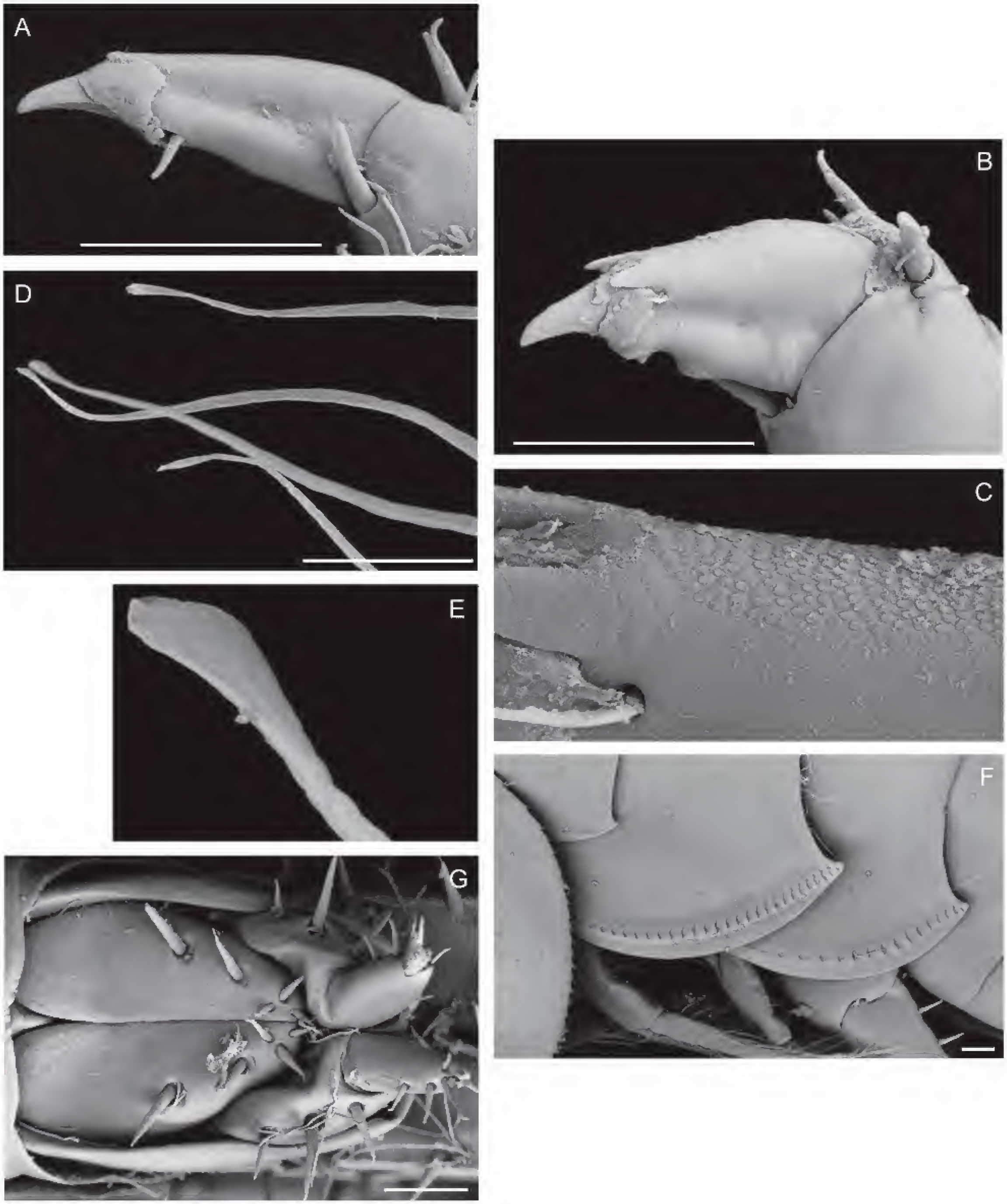

Figure 3. *Floresorchestia poorei* sp. nov., A–C, paratype, female, AM P80543: A, pereopod 3 dactylus; B, pereopod 4 dactylus; C, denticulate patch on dactylus of pereopod 4; D–G, paratype female, AM P80532: D–E, spatulate setae on oostegite of gnathopod 2; F, stridulating organ on epimera 2 and 3, basis of pereopod 7 posterior margin; G, telson and uropod 3. Scale bars: A, B, F and G represent 100 μm, D represents 20 μm.

slightly different forms depending on their position on the lobes. Whatever the function these lobes are widespread within the talitrids. In males they are found on different combinations of the merus, carpus and propodus of gnathopod 1 and in females, and males of a number of land-hopper genera, they occur on gnathopod 2.

On the surface of the propodus of gnathopod 1 there are least two types of sensory setae. Both of these setal types appear to have pores at the tips. Cuspidate setae occur along the palm (fig. 1G) and on the lateral and medial surfaces (fig. 1I). A short, slender, sharp projection arises from the side of the shaft and a row of denticles covers the distal end. At the tip is a distinct pore. The posterolateral serrate setae (fig. 1E, F) have a long, slender shaft with setules, distal denticles and a terminal pore, similar to the plumodenticulate setae of Watling (1989, 22, fig. 4E) and the serrate setae of Garm (2004, fig 8a, c).

On male gnathopod 2 the anterior margin of the basis and ischium develop lateral and medial flanges which form a cradle for the propodus (fig. 2A). The dactylus is distally attenuated and fits into a groove along the posteromedial margin of the propodus (fig. 2B). At the corner of the palm where the groove begins there is a distinct cuticular patch of tiny denticles (fig. 2C). This patch forms an abrasive pad which may assist holding.

The cuspidate dactylus of pereopod 3 tapers evenly along its margin (fig. 3A), but the dactylus of pereopod 4 is thickened at the base and a distinct notch occurs along the posterior margin (fig. 3B). On the anterodistal margin of the dactyli of pereopods 3 and 4 there is a dense patch of about 20 rows of what appears to be tiny denticles (fig. 3C). These patches occur in other talitrids and also on pereopods 5–7. A patch of what appears to be spatulate setae is shown on the dactylus of pereopods 5 and 6 of *Notorchestia naturaliste* (Serejo & Lowry 2008: 186, fig. 18). The function of these patches is not known.

Among female talitrids three types of setae have been documented on the oostegites: simple setae, curl-tipped setae and setae with multi-furcate tips. In *Floresorchestia poorei* a fourth type occurs. The long slender setae (fig. 3D) become splayed at the tip (fig. 3E) to form a spatulate locking mechanism.

Although 'slits' on the epimeral plates of *Floresorchestia* have been mentioned many times, only Bousfield (1970, 1971) has ever considered their function as stridulating organs. The serrate posterior margin of the basis of pereopod 7 has also been mentioned many times, most recently by Miyamoto & Morino (2008). We have had a close look at this morphology (figs 3F). The so called 'slits' are relatively complex structures with a raised anterior border and an immediately posterior hollow bowl or slit. Bousfield (1970, 1971) referred to these structures as stridulating ridges and we agree that these ridges form a stridulating organ. And the stridulator appears to be the unique, strongly serrate posterior margin with tiny robust setae on the basis of pereopod 7. The interesting thing is that they occur on both sexes so the function is probably not to attract a mate.

The telson in *Floresorchestia* may be entire, apically notched partially cleft or in the case of *F. poorei* completely cleft (fig. 3G). The telson appears to be enclosed by the sides of urosomite 3 and the peduncle of uropod 3.

Material and methods

The descriptions were generated from a DELTA database (Dallwitz 2005) to the talitrid genera and species of the world. All material is lodged in the Australian Museum, Sydney (AM). Abbreviations are: **A**, antenna; **G**, gnathopod; **UL**, upper lip; **MD**, mandible; **LL**, lower lip; **MX**, maxilla; **MP**, maxilliped; **P**, pereopod; **pl**, pleopod; **T**, telson; **U**, uropod; **L**, left; **R**, right.

Talitridae Rafinesque, 1815

Floresorchestia Bousfield, 1984

Orchestia floresiana group Bousfield, 1971: 267.

Floresorchestia Bousfield, 1984: 205. —Miyamoto & Morino, 2008: 838.

Type species. *Orchestia floresiana* Weber, 1892, original designation.

Included species. *Floresorchestia* includes 14 species: *F. ancheidos* (K. H. Barnard, 1916); *F. anomala* (Chevreux, 1901); *F. anoquesana* (Bousfield, 1971); *F. anpingensis* Miyamoto & Morino, 2008; *F. floresiana* (Weber, 1892); *F. guadalupensis* Ciavatti, 1989; *F. hanoiensis* Hou & Li, 2003; *F. monospina* (Stephensen, 1935); *F. pectenispina* (Bousfield, 1970); *F. pickeringi* (Dana, 1853); *F. poorei* sp. nov.; *F. samoana* (Bousfield, 1971); *F. vitilevana* (J.L. Barnard, 1960); *F. yehyuensis* Miyamoto & Morino, 2008.

Description. *Head*. *Mandible* left lacinia mobilis 5-dentate or 4-dentate. *Maxilliped* palp article 2 distomedial lobe well developed, article 4 reduced, button-shaped.

Pereon. *Gnathopod 1* posterior margin of merus, carpus and propodus each with lobe covered in palmate setae; palm transverse. *Gnathopod 2* subchelate. *Pereopods 2–4* coxae wider than deep. Pereopods 6–7 longer than pereopods 3–5. *Pereopod 6* posterior lobe inner view posteroventral corner subquadrate or posteroventral corner rounded. *Pereopod 7* basis posterior margin with distinct minute serrations, each with a small seta.

Pleon. *Pleopods* all well developed. *Pleopod 1* peduncle with or without sparse marginal setae. *Pleopod 2* peduncle with or without sparse marginal setae; outer ramus longer than peduncle. *Pleopod 3* peduncle with or without marginal robust setae. *Epimera 2–3* each with stridulating organs just above ventral margins. *Uropod 1* peduncle distolateral robust seta present; inner ramus with marginal robust setae; outer ramus without marginal robust setae or with one long midmedial seta (in male). *Uropod 2* not sexually dimorphic; outer ramus with marginal robust setae. *Uropod 3* ramus shorter than peduncle. *Telson* with marginal and apical robust setae.

Female (sexually dimorphic characters). *Gnathopod 1* posterior margin of merus, carpus and propodus each without lobe covered in palmate setae; palm slightly acute. *Gnathopod*

2 mitten-shaped.

Habitat. Supralittoral and terrestrial amphipods of tropical rain forests, mangroves and beaches in the Indo-West Pacific and Caribbean.

Remarks. Floresorchestia belongs to a group of Indo-West Pacific genera which includes *Microrchestia* Bousfield, 1984, *Platorchestia* Bousfield, 1982, *Protorchestia* Bousfield, 1982, *Sinorchestia* Miyamoto & Morino, 1999 and *Talorchestia* Dana, 1853. They all share a 5 dentate left lacinia mobilis, subchelate male gnathopod 2, well developed pleopods and uropod 1 without marginal robust setae on the outer ramus (except *Sinorchestia nipponensis* which has marginal robust setae on the outer ramus). Within the group *Floresorchestia*, *Platorchestia*, *Sinorchestia* and *Talorchestia* have cuspidactylate pereopods. Only *Floresorchestia* and *Platorchestia* have the reduced button-shaped fourth articles on the palps of the maxilliped and distally attenuated dactyli on male second gnathopods. Both of these genera have wide distributions.

Floresorchestia monospina (Stephensen, 1935) and *F. pectenispina* (Bousfield, 1970) differ from other species in the genus in having a long, marginal slender robust seta with a modified tip on the outer ramus of male uropod 1 (Bousfield 1970). *Floresorchestia hanoiensis* Hou & Li, 2003, *F. malayensis* (Tattersall, 1921), *F. samoana* (Bousfield, 1971) and *F. vitilevana* (J.L. Barnard, 1960) differ from other species in the genus in not having stridulating organs on epimera 2 and 3. In other respects these species appear to be *Floresorchestia* and *F. hanoiensis* has pitting on the face of epimera 1 and 2. *Floresorchestia pickeringi* (Dana, 1853) needs to be redescribed to confirm its status in the genus.

Floresorchestia ancheidos (K.H. Barnard, 1916), *F. anomala* (Chevreux, 1901) and *F. floresiana* (Weber, 1892), type species of the genus, are all poorly described species and *F. anomala* and *F. floresiana* are the source of questionable synonymies from wide-ranging localities. These species also need to be redescribed based on new material from the type localities using modern characters as outlined by Miyamoto & Morino (2008) before realistic distributions for species in the genus can be determined.

Floresorchestia poorei sp. nov.

(Figures 1 – 7)

Material examined. Holotype: Indian Ocean, Cocos (Keeling) Islands, West Island, Rumah Baru, (12°09'22"S 96°49'41"E), beach wrack, J.K. Lowry and K.B. Attwood, 8 Oct 2008, (stn MI WA 819), AM P80192 (ovigerous female, 9.2 mm).

Paratypes: type locality, AM P80193 (male, 11.7 mm); AM P80194 (many specimens); AM P80532 (female); AM P80543 (female); AM P80544 (male); AM P80549 (male).

Other material: Indian Ocean, Cocos (Keeling) Islands, West Island, Government House Beach, (12°05'04"S 96°52'54"E), sand beach, J.K. Lowry, L.E. Hughes and K.B. Attwood, 7 Oct 2008, (stn MI WA 780), AM P.80545 (many specimens). Indian Ocean, Cocos (Keeling) Islands, West Island, beach near "Two Trees dive site", (12°05'04"S 96°52'54"E), J.K. Lowry, L.E. Hughes and K.B. Attwood, 7 Oct 2008, (stn MI WA 779), AM P.80547 (6 males, 7 females).

Type locality. Rumah Baru, West Island, Cocos (Keeling) Islands, Indian Ocean (12°09'22"S 96°49'41"E).

Etymology. Named for our good friend Gary Poore in thanks for his help over the years and in recognition of his immense contribution to the field of carcinology.

Description. Based on holotype, ovigerous female, AM P80192.

Head. Eye large (greater than 1/3 head length). *Antenna 1* short, rarely longer than article 4 of antenna 2 peduncle. *Antenna 2* up to half body length; peduncular articles narrow; article 5 longer than article 4. *Mandible* left lacinia mobilis 5-dentate. *Maxilliped* palp article 2 distomedial lobe well developed, 4 reduced, button-shaped.

Pereon. Gnathopod 1 sexually dimorphic; parachelate; coxa 1 smaller than coxa 2; posterior margin of merus, carpus and propodus each without lobe covered in palmate setae, in male only; propodus subrectangular, propodus posterior margin with 3 cuspidate setae along posterior margin, propodus posterior margin with 3 serrate setae along posterior margin; palm acute, palm with 4 serrate setae; dactylus longer than palm. *Gnathopod 2* sexually dimorphic; mitten-shaped; coxal gill simple or slightly lobate; basis anterior margin smooth, basis expanded proximally; ischium without posterodistal lobe on medial surface; posterior margin of merus, carpus and propodus each with lobe covered in palmate setae; carpus well developed (not enclosed by merus and propodus), posterior lobe present, projecting between merus and propodus; palm obtuse, smooth, not lined with robust setae, palm without patch of tiny denticles at corner of palm; dactylus subequal in length to palm, not attenuated distally; gill simple, not incised. *Pereopods 2–4* coxae wider than deep. *Pereopods 3–7* cuspidactylate. *Pereopod 4* subequal or slightly shorter than pereopod 3; carpus significantly shorter than carpus of pereopod 3; dactylus thickened proximally with a notch midway along the posterior margin. *Pereopod 5* propodus distinctly longer than carpus. *Pereopods 6–7* longer than pereopods 3–5. *Pereopod 6* not sexually dimorphic; slightly shorter than pereopod 7; posterior lobe inner view posteroventral corner rounded, posterior margin perpendicular to ventral margin, posterior lobe with ridge, posterior lobe with 1–2 marginal setae. *Pereopod 7* not sexually dimorphic; basis lateral sulcus absent, basis posterior margin with distinct minute serrations, each with a small seta, posterodistal lobe present, shallow, broadly rounded; distal articles (merus and carpus) slender; merus posterior margin evenly rounded; propodus setation without large distal tuft of setae. *Oostegites* long (length greater than 2 x width), longer than wide, weakly setose (6–11 setae), setae with spatulate tips.

Pleon. Pleopods all well developed. *Pleopod 1* peduncle with marginal slender setae; biramous, outer ramus shorter than peduncle, inner ramus subequal in length to outer; inner ramus with 9 articles; outer ramus with 6 articles. *Pleopod 2* peduncle with marginal slender setae; biramous, inner ramus subequal in length to outer, outer ramus shorter than peduncle; inner ramus with 7 articles. *Pleopod 3* peduncle without marginal setae. *Pleopod 3* biramous, inner ramus subequal in length to outer, outer ramus shorter than peduncle; rami

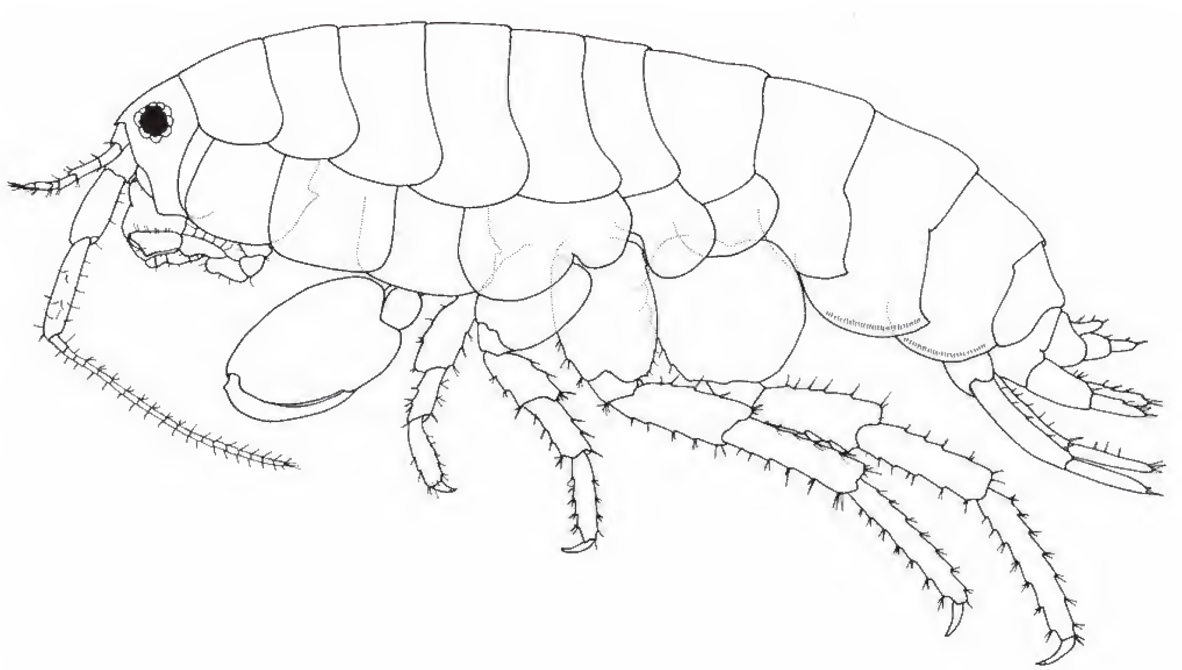

Figure 4. *Floresorchestia poorei* sp. nov., paratype, male, 11.7 mm, AM P80193.

multarticulate; inner ramus with 6 articles; outer ramus with 6 articles. *Epimera 2–3* each with a stridulating organ just above ventral margins. *Epimera 2* subequal in length to epimeron 3, with 27 ridges. *Epimera 3* with 17 ridges, posterior margin smooth, without setae, posteroventral corner with small subacute tooth, ventral margin without robust setae. *Uropod 1* not sexually dimorphic, peduncle with 8 robust setae, distolateral robust seta small; with simple tip; inner ramus subequal in length to outer ramus, with 3 marginal robust setae; outer ramus without marginal robust setae. *Uropod 2* not sexually dimorphic; peduncle with 6 robust setae; inner ramus subequal in length to outer ramus, with 2 marginal robust setae; 1 marginal robust setae. *Uropod 3* peduncle with 3 robust setae; ramus shorter than peduncle, ramus linear (narrowing), with 2 marginal robust setae, with 4–5 apical setae. *Telson* longer than broad, completely cleft, with 5 marginal and apical robust setae per lobe.

Male (sexually dimorphic characters). Based on male, AM P80193. *Gnathopod 1* subchelate, posterior margin of merus, carpus and propodus each with lobe covered in palmate setae; propodus subtriangular with well developed posterodistal lobe, anterior margin with 3 groups of robust setae, lateral surface with 2 cuspidate setae, posterolateral surface with 5 serrate setae, propodus posterior margin without cuspidate or serrate setae along posterior margin; palm transverse, dactylus subequal in length to palm. *Gnathopod 2* subchelate; basis slightly expanded; ischium distal triangular posterodistal lobe on medial surface; posterior margin of merus, carpus and propodus each without lobe covered in palmate setae; carpus triangular, reduced (enclosed by merus and propodus), posterior lobe absent, not projecting between merus and propodus; propodus subovate; propodus twice as long as wide; palm acute, lined with robust setae; palm with cuticular patch of tiny denticles at corner of palm, posteromedial surface of propodus with groove; dactylus longer than palm, attenuated distally.

Habitat. Living in the supralittoral zone on sheltered beaches under seaweeds and debris.

Remarks. Floresorchestia poorei is currently the only species in the genus with a fully cleft telson.

Distribution. North-Eastern Indian Ocean. Cocos (Keeling) Islands (current study).

Acknowledgements

Thanks to the CAAP team, Kate Attwood, Lauren Hughes and Michael Stuckey for helping to collect the beach-hoppers; to Tania Laity, Department of the Environment, Water, Heritage and the Arts (DEWHA) for funding the field work; to Sue Lindsey for the SEM micrographs; to Anders Garm and Les Watling for advice on setal types; to Alan Myers, as always, for his insightful comments; and to Jo Taylor for inviting us to contribute to this book celebrating 30 years of scholarly research by Gary Poore.

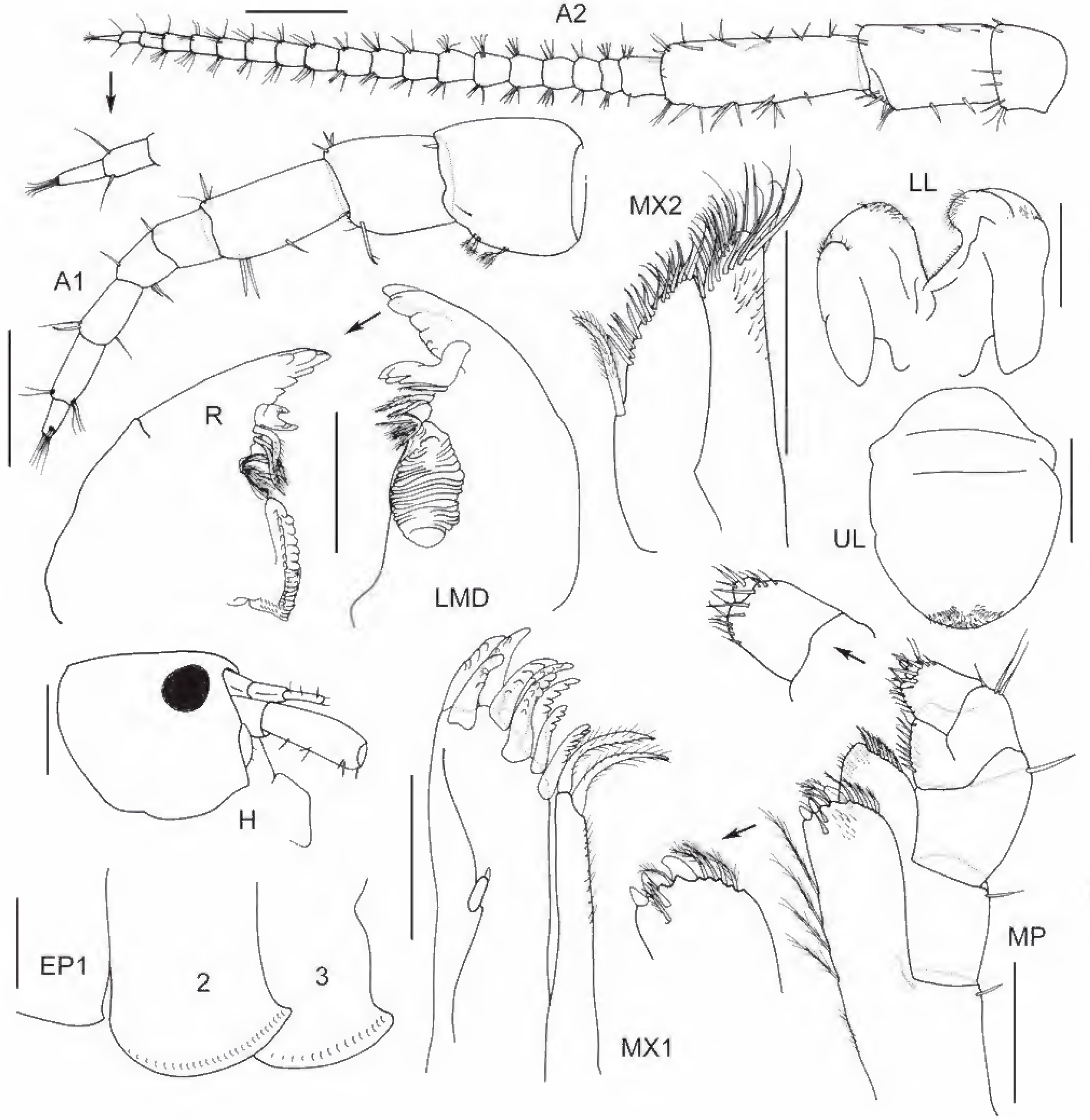

Figure 5. *Floresorchestia poorei* sp. nov., holotype, ovigerous female, 9.2 mm, AM P80192. Scale bars: H, Ep1–3 represent 0.5 mm, remainder represent 0.2 mm.

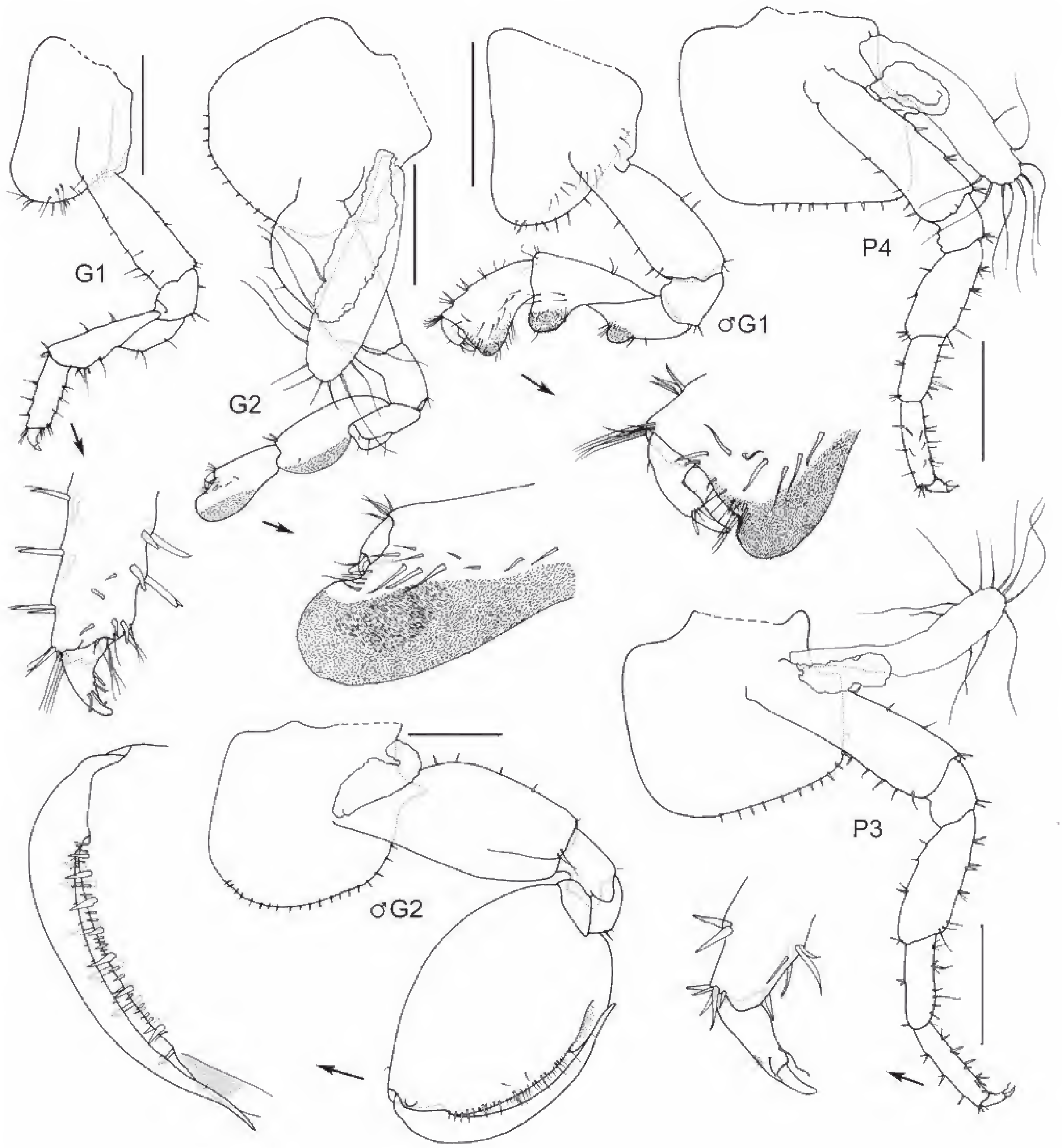

Figure 6. *Floresorchestia poorei* sp. nov., holotype, ovigerous female, 9.2 mm, AM P80192, paratype, male, 11.7 mm, AM P80193. Scale bars represent 0.5 mm.

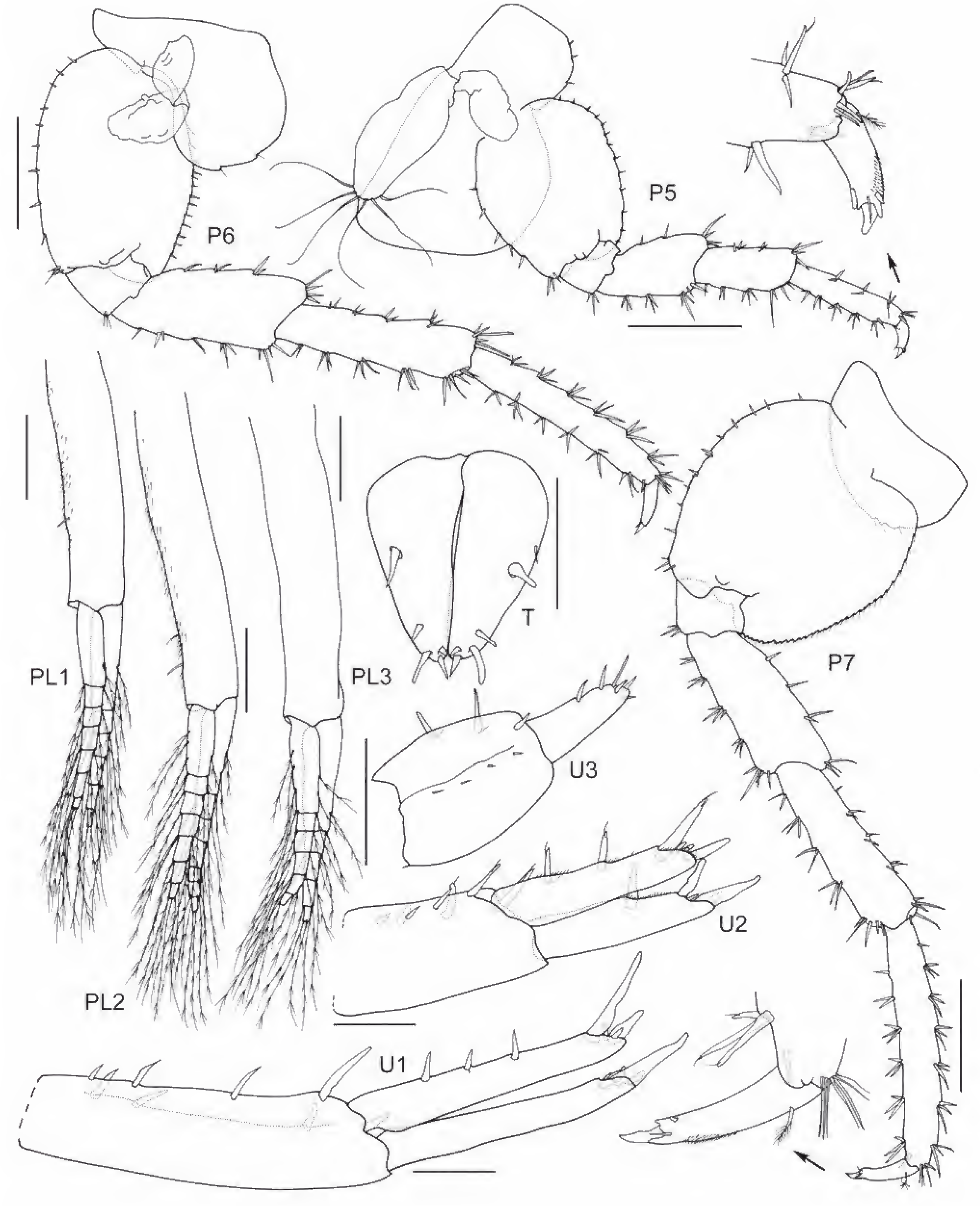

Figure 7. *Floresorchestia poorei* sp. nov., holotype, ovigerous female, 9.2 mm, AM P80192. Scale bars: P5–7 represent 0.5 mm, remainder represent 0.2 mm.

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Epikopais gen. nov. (Isopoda: Asellota: Munnopsidae), a new genus of munnopsid isopod with three new species from the south-western Pacific.

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Abstract

Merrin, K.L. 2009. *Epikopais* gen. nov. (Isopoda: Asellota: Munnopsidae), a new genus of munnopsid isopod with three new species from the south-western Pacific. *Memoirs of Museum Victoria* 66: 129–145.

A new munnopsid isopod genus from the southern hemisphere, *Epikopais* gen. nov. is described here and includes *Epikopais aries* (Vanhöffen, 1914) comb. nov. from Antarctica and three new species described here from the south-west Pacific: *Epikopais mystax* sp. nov. from the Bounty Trough east of the South Island of New Zealand; and *Epikopais poorei* sp. nov. and *Epikopais waringa* sp. nov., both from the south-eastern Australian continental slope. *Epikopais* gen. nov. can be distinguished by the combination of the short laterally rounded cephalic frons; the absence of dorsal spines; the lack of a mandibular palp; the mandibular fossa, which curves along the lateral margin of the mandible; and the biramous uropods.

Keywords Crustacea, Isopoda, Munnopsidae, *Epikopais*, deep-sea, Australia, New Zealand.

Introduction

The earliest species from the isopod family Munnopsidae Lilljeborg, 1864 to be described from the south-west Pacific were *Vanhoeffenura novaezelandiae* (Beddard, 1885) and *Munnopsis gracilis* Beddard, 1885 which were both collected from off New Zealand during the round-the world voyage of the HMS *Challenger* in the early 1870's. Despite these early beginnings, few species of south-west Pacific Munnopsidae have since been described with the most being from the subfamily Ilyarachninae Hansen, 1916 (see Merrin 2004, Merrin 2006, Merrin and Bruce 2006, Merrin et al. 2009).

Epikopais gen. nov. is the seventh genus to be described from the subfamily Ilyarachninae and the second to be known exclusively from the southern hemisphere. The first, *Notopais* Hodgson, 1910, has been recorded from only waters around Antarctica, south-eastern Australia and New Zealand (Merrin 2004, Merrin and Bruce 2006). Two of the new species described in this paper, *Epikopais waringa* sp. nov. and *Epikopais poorei* sp. nov. were collected during Museum Victoria's SLOPE expeditions of south-eastern Australia between 1979 and 1988. These expeditions yielded a high diversity of isopod species (Poore et al. 1994) and many new species have been described in recent years (for example see Brandt 1994, Cohen & Poore 1994, Just 2001a, 2001b, 2009, Merrin and Poore 2003, Brix 2006). *Epikopais mystax* sp. nov. was collected from the Bounty Trough east of New Zealand.

The type material used in the preparation of the illustrations and descriptions are indicated in the figure captions. Specimens were drawn using a Nikon Optiphot-2 compound microscope and a Zeiss Stemi SV 11 dissecting microscope, both fitted with a camera lucida. Species descriptions were prepared using DELTA (Dallwitz et al. 1999). Ratios were calculated using the maximum lengths and widths of segments unless otherwise mentioned in the text. With antennal articles the most basal article is referred to as article 1, the next article as article 2 and so on. Directional information concerning pereopods follows Brusca et al. (1995).

Abbreviations

SS simple seta/e; RS robust seta/e; NIWA National Institute for Water and Atmospheric Research, Wellington New Zealand; NMV Museum Victoria, Melbourne Australia.

Taxonomy

Family Munnopsidae Lilljeborg, 1864

Subfamily Ilyarachninae Hansen, 1916

Epikopais gen. nov.

Type species. *Epikopais poorei* sp. nov., here designated.

Diagnosis. Cephalic frons short, laterally rounded; cephalon anterior flanges present; pereonites 1–4 margins with simple setae, dorsal spines absent; pereonites 5–7 lateral margins without elongate spines or jagged edges. Pleon without dorsal and anterolateral spines. Antennae positioned closely together, centrally; antenna 1 article 1 with one distal point, lateral flange absent; antenna 2 article 1 without anterolateral spine. Mandible incisor rounded, with no defined cusps; spine row either present or absent; lacinia mobilis and palp both absent; mandibular fossa curved along lateral margin of mandible; molar smaller than condyle, narrowing distally. Maxilla 2 middle and lateral lobes each distally with 4 long pectinate setae. Pereopod 2 ambulatory, not enlarged; pereopods 5 and 6 carpi expanded, flattened, sub-circular; propodi expanded, flattened, oar-like; pereopods 5–7 ischia superior margin, carpi and propodi inferior and superior margins each with row of plumose setae. Operculum large, with prominent medial keel, lateral margins setose; pleopod 4 exopod with one plumose seta; pleopod 5 simple lobe. Uropods biramous, with large exopod.

Species included. Epikopais aries (Vanhöffen, 1914) comb. nov.; *Epikopais mystax* sp. nov.; *Epikopais poorei* sp. nov.; and *Epikopais waringa* sp. nov.

Remarks. Epikopais gen. nov. can be distinguished by the combination of: the short laterally rounded cephalic frons; the absence of dorsal spines; the lack of a mandibular palp; the mandibular fossa, which curves along the lateral margin of the mandible; and the biramous uropods with a prominent exopod.

The laterally rounded shape of the cephalic frons is unique within the Ilyarachninae. In *Ilyarachna*, *Notopais* and *Bathybadistes* Hessler and Thistle, 1975, the cephalic frons is wide and almost rectangular in shape, and lack the lateral roundness found in *Epikopais*. In *Aspidarachna* Sars, 1897, the cephalic frons is very narrow with distance between the antennae and the labrum the smallest of all the Ilyarachninae. The shape of the mandibular fossa is also unique in the Ilyarachninae. The general shape of the mandibular fossa in this subfamily is angular and does not curve along the lateral margin of the mandible as it does in *Epikopais*.

Like *Epikopais*, *Notopais* and *Echinozone* Sars, 1897 also lack a mandibular palp and have biramous uropods. In addition to the differences found in the cephalic frons and the mandibular fossa, *Epikopais* can be distinguished from *Notopais* as it lacks the pronounced spine on the first article of antenna 2, and it can be distinguished from *Echinozone* as it lacks dorsal spines.

The only previously described species of this genus, *Epikopais aries*, is based on a single specimen collected from Antarctica and originally place in *Aspidarachna*, by Vanhöffen (1914). This species was then moved to *Echinozone* by Hessler and Thistle (1975). Comparing the holotype of *E. aries* with the other species of *Epikopais* shows that this species belongs in *Epikopais*.

Epikopais is known from Antarctica, south-western Australia and New Zealand, at depths between 385–1586 metres.

Etymology. Epikopais is derived from the Greek word epikopos, meaning furnished with oars, in reference to the natatory pereopods of these animals.

Key to the species of *Epikopais*

—Body not covered in setae; anterolateral cephalic flanges large; opercular keel wide, bulbous, not elongate 2

—Body covered in setae; anterolateral cephalic flanges small; opercular keel elongate, not bulbous .... *Epikopais poorei* sp. nov.

—Frons with elongate setae above labrum 3

—Frons without elongate setae above labrum .... *Epikopais aries* (Vanhöffen, 1914).

—Pereonites 5–7 together much longer than pereonites 1–4; pereonite 5 anterior margin with few setae; pereonite 7 anteriorly wide; operculum keel, wide, short, triangular .... *Epikopais waringa* sp. nov.

—Pereonites 5–7 together sub-equal with pereonites 1–4; pereonite 5 anterior margin with many setae; pereonite 7 anteriorly narrowing; operculum keel longer, not triangular .... *Epikopais mystax* sp. nov.

***Epikopais poorei* sp. nov.**

Figures 1–5

Material examined. All off south-eastern Australia. Holotype. Ovigerous female (2.4 mm), 44 km E of Nowra, NSW, stn SLOPE 56, 34°55.79–56.06'S, 151°08.06–07.86'E, 22 October 1988, WHOI epibenthic sled, 429–466 m, RV *Franklin*, muddy coarse shell (NMV J18844). Paratypes. 22 females, 21 males (1 male, 2.0 mm, dissected) 2 fragments, type locality (NMV J54112), 2 females (2.3 mm, dissected, 2.0 mm partially dissected), south of Point Hicks, Victoria, stn SLOPE 33, 38°19.60'S, 149°24.30'E, 23 July 1986, 930 m, WHOI epibenthic sled, RV *Franklin* (NMV J18845).

Additional material. 8 females, 7 males, 5 fragments, south of Point Hicks, Victoria, stn SLOPE 40, 38°17.70'S, 149°11.30'E, 24 July 1986, WHOI epibenthic sled, 400 m, RV *Franklin*, coarse sand, gravel, mud (NMV J18843).

Description. Female. Body length 2.1 times width of pereonite 2; cuticle not highly calcified, setose. Cephalon spines absent; anterior cephalic flanges small. Pereonites 1–4 anterior margins with few SS. Pereonite 5 anterior margin smooth; anterolateral margins of pereonites 4, 6 and 7 with small lobes; pereonite 6 ventrally with no ornamentation; pereonite 7 ventrally with pair of setae. Pleon length 0.9 times proximal width, with scattered SS.

Female antenna 1 of 9 articles; article 1 length 1.8 times width, mesial margin with 1 sensillate RS and 4 SS, surface with 4 SS, 2 penicillate setae and 1 sensillate RS, lateral margin with 7 SS, distal margin with 5 SS and 1 penicillate seta; article 2 length 0.6 times article 1, with 4 sensillate RS and 1 penicillate seta, distal extension with 2 penicillate setae; article 3 with 1 SS; article 4 with 2 penicillate setae; article 5 with 1 SS; terminal article with 1 penicillate seta and 2 SS.

Mandible spine row absent, molar distally with 4 serrate setae; socket-like structure with 1 SS at approximate place of mandibular palp. Maxilla 1 lateral and mesial margins with fine SS; lateral lobe width 1.5 times mesial lobe width, distal margin with few fine SS, 3 RS, 3 dentate RS and 6 pectinate

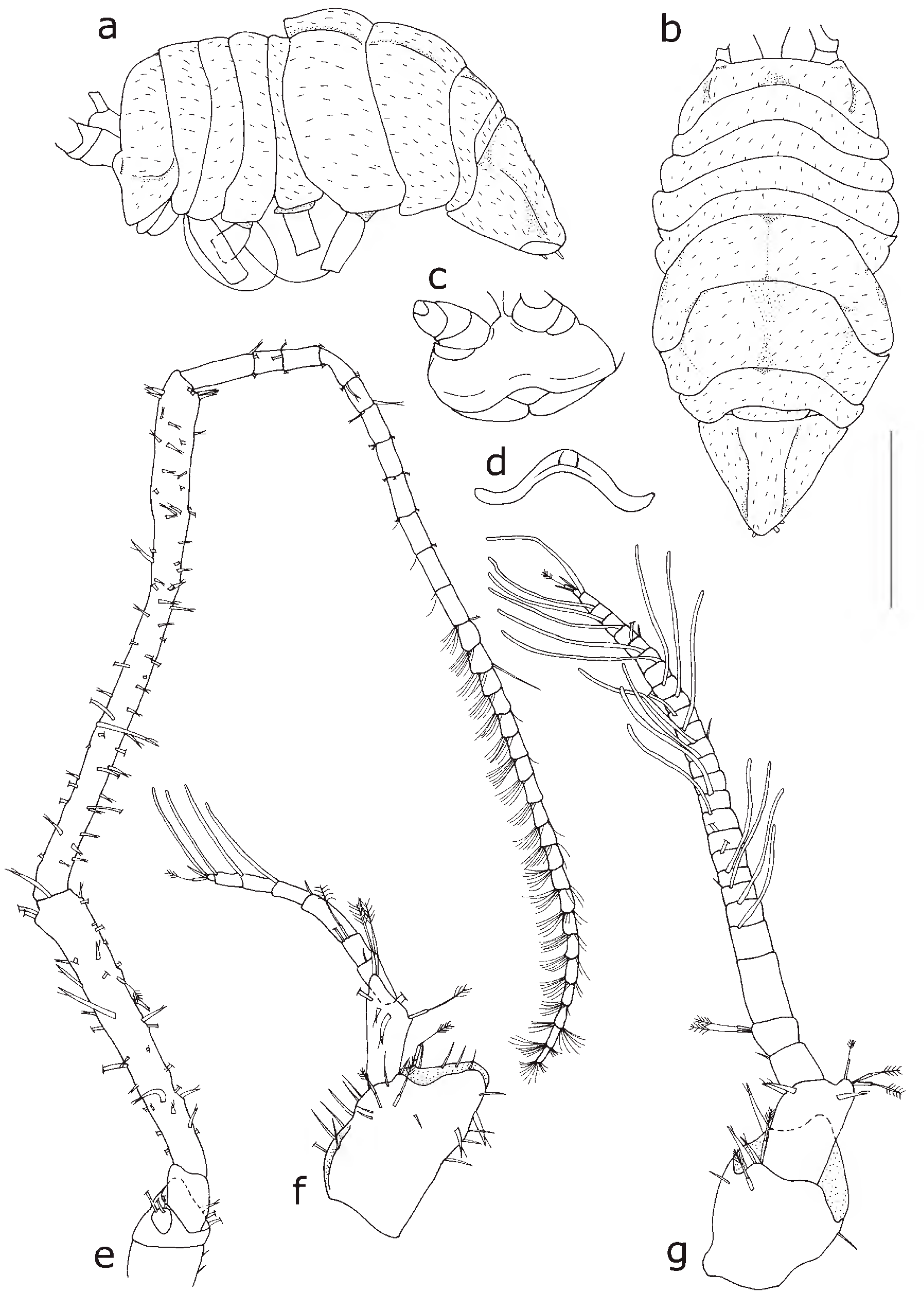

Figure 1. *Epikopais poorei* gen. nov., sp. nov. a–c, female holotype, 2.4 mm (NMV J18844); d, f, female paratype, 2.3 mm (NMV J18845); e, g, male paratype, 2.0 mm (NMV J54112): a, lateral view; b, dorsal view; c, cephalon; d, ventral view of pereonite 7; e, right antenna 2; f, left antenna 1; g, right antenna 1. Scale bar = 1 mm, for dorsal and lateral views only.

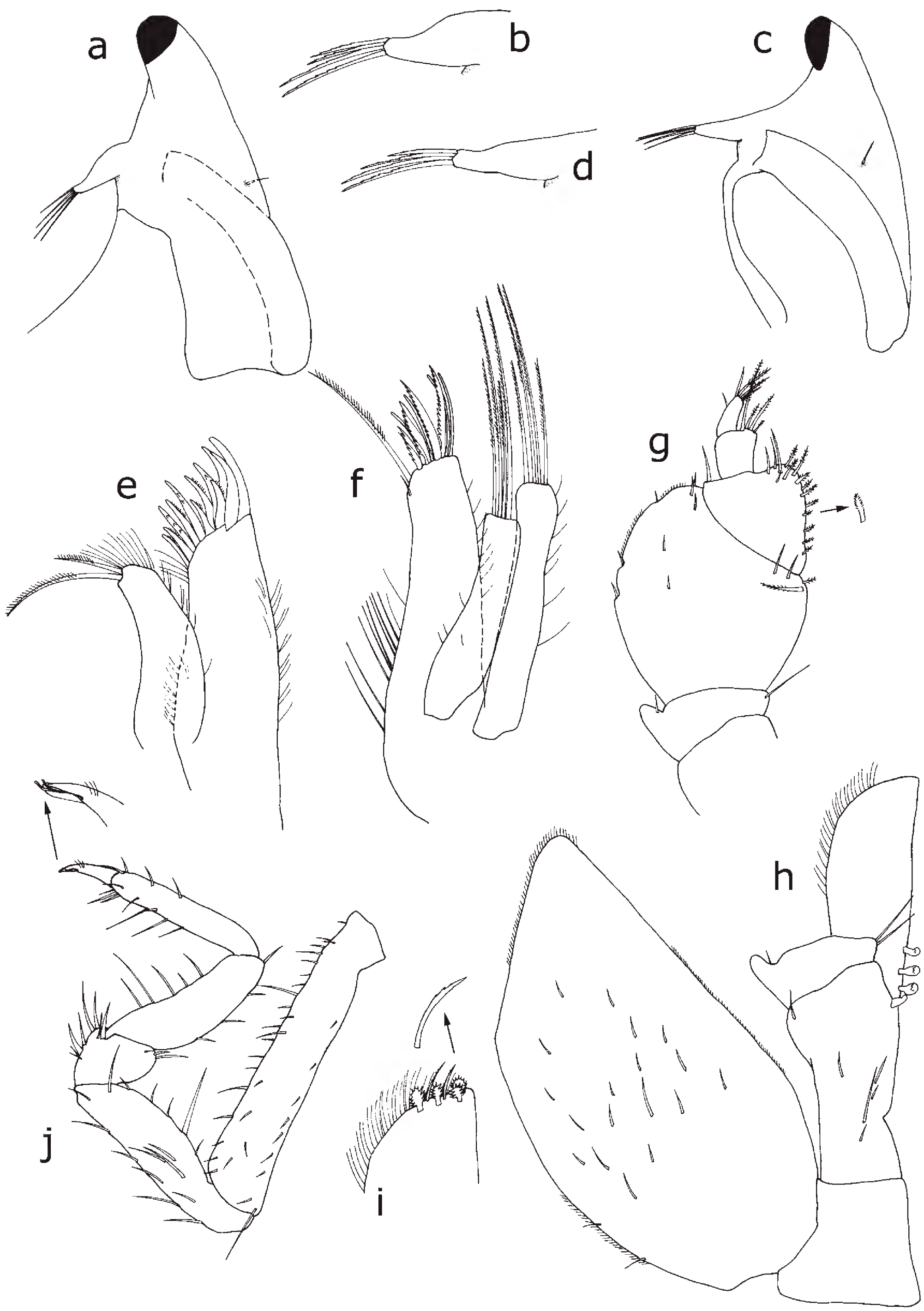

Figure 2. *Epikopais poorei* gen. nov., sp. nov. All figures from female paratype, 2.3 mm (NMV J18845): a, left mandible; b, left mandibular molar; c, right mandible; d, right mandible molar; e, left maxilla 1; f, left maxilla 2; g, right maxilliped palp; h, right maxilliped; i, right maxilliped endite; j, right pereopod 1.

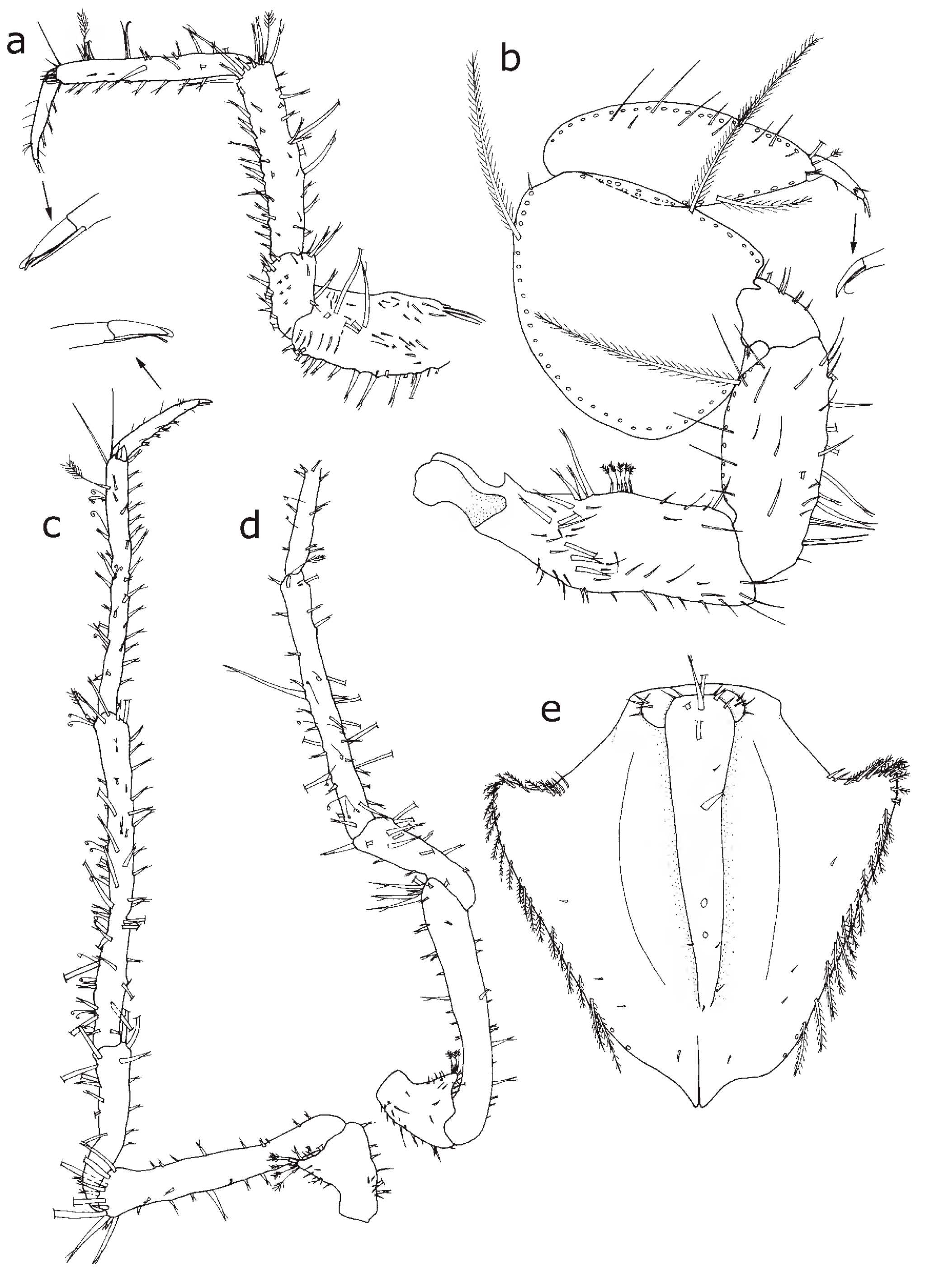

Figure 3. *Epikopais poorei* gen. nov., sp. nov. a–d, female paratype, 2.3 mm (NMV J18845); e, female paratype, 2 mm (NMV J18845): a, left pereopod 2; b, left pereopod 5; c, right pereopod 4; d, left pereopod 3; e, operculum.

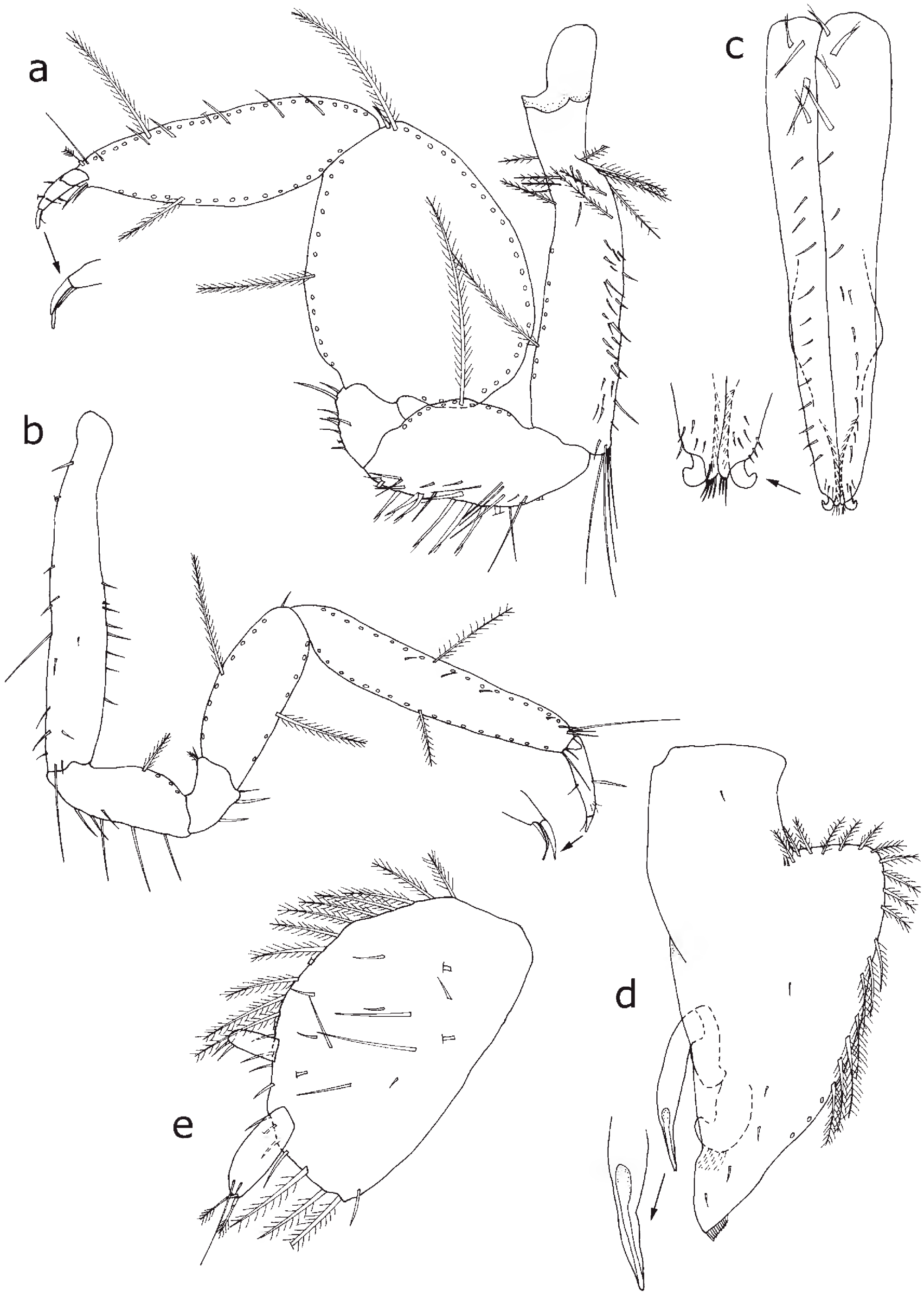

Figure 4. *Epikopais poorei* gen. nov., sp. nov. a, b, e, female paratype, 2.3 mm (NMV J18845); c, d, male paratype, 2 mm (NMV J54112): a, right pereopod 6; b, left pereopod 7; c, pleopod 1; d, left pleopod 2; e, left uropod.

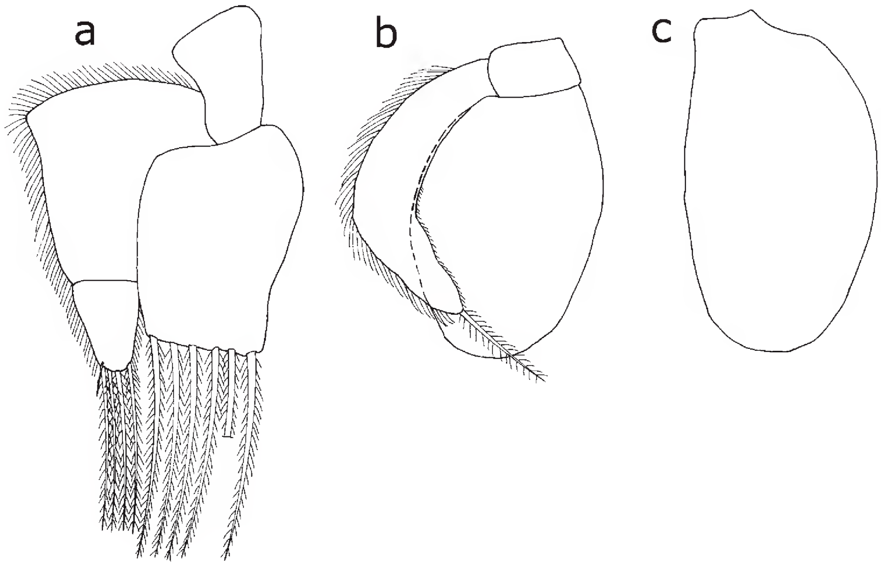

Figure 5. *Epikopais poorei* gen. nov., sp. nov. All figures from female paratype, 2.3 mm (NMV J18845): a, right pleopod 3; b, right pleopod 4; c, right pleopod 5.

RS, mesial lobe distally with many fine SS and 2 long pectinate setae. Maxilla 2 lateral lobe margins with fine SS; middle lobe width 1.2 times lateral lobe width; mesial lobe width 2.2 times lateral lobe width, margins with fine SS, proximally mesial margin also with 8 elongate setae (unable to tell what type), distally with 3 blunt SS, 4 toothed setae, 1 long pectinate seta and few fine SS. Maxilliped coxa length 0.9 times width, and 3.2 times basis length; basis length 3.7 times width, with 5 SS, distolateral margin with 1 SS; endite with 4 coupling hooks, 2 toothed setae, 4 fan setae and few fine SS; palp article 1 distolateral margin with 1 SS, distomesial margin with 1 SS; article 2 length 3.2 times article 1 length, lateral margin with cuticular scales and 4 SS, surface with 6 SS, mesial margin with 2 distally pappose setae and 2 SS; article 3 length 1.6 times article 1 length, lateral margin with 1 SS, mesial margin with 4 SS and 11 distally pappose setae; article 4 length 0.7 times article 1 length, mesial margin with 4 distally pappose setae; article 5 length 0.6 times article 1 length, lateral margin with 1 SS, distally with 2 SS and 2 distally pappose setae; epipod length 2.0 times width, margins with cuticular scales and surface with scattered SS.

Pereopod 1 basis length 4.9 times width, lateral surface with 18 SS, superior margin with 16 SS; ischium length 3.2 times width, inferior margin with 4 SS, lateral surface with 7 SS, superior margin with 4 SS and 1 RS; merus length 0.9 times width, inferior margin with 3 SS and 5 RS, lateral surface with 1 SS, distosuperior margin with 2 SS; carpus length 2.1 times width, inferior margin with 5 SS, superior margin with 4 SS; propodus length 5.4 times width, inferior margin with 6 SS, lateral surface with 3 SS, superior margin with 4 SS; dactylus length 3.4 times proximal width, distosuperior margin with 3 small SS.

Pereopod 2 broken; ischium damaged, inferior margin with 18 sensillate RS, lateral surface with 5 sensillate RS and 36 SS; merus length 1.7 times width, inferior margin with 10 sensillate RS, lateral surface with 4 SS and 6 sensillate RS, superior margin with 2 sensillate RS, distosuperior margin with 2 sensillate RS and 1 SS; carpus length 5.1 times width, inferior margin with 17 sensillate RS, lateral surface with 10 sensillate RS and 4 SS, superior margin with 19 sensillate RS and 1 penicillate seta; propodus length 8.0 times width, inferior margin with 8 sensillate RS, lateral surface with 3 sensillate RS and 2 SS, distal margin with 7 SS, superior margin with 1 penicillate seta, 8 sensillate RS and 7 SS; dactylus length 4.5 times proximal width, superior margin with 6 SS, inferior margin with 2 SS and 3 sensillate RS.

Pereopod 3 basis length 1.2 times width, inferior margin with 2 sensillate RS and 7 SS, lateral surface with 15 SS, superior margin with 5 penicillate setae and 5 SS; ischium length 5.2 times width, inferior margin with 8 sensillate RS and 3 SS, lateral surface with 55 sensillate RS, superior margin with 14 sensillate RS; merus length 2.6 times width, inferior margin with 6 sensillate RS, lateral surface with 5 sensillate RS, distosuperior margin with 3 sensillate RS; carpus length 9.9 times width, inferior margin with 12 sensillate RS, lateral surface with 11 SS, 1 penicillate seta and 6 sensillate RS, superior margin with 11 sensillate RS; propodus damaged; dactylus absent.

Pereopod 4 basis length 1.2 times width, inferior margin with 5 sensillate RS and 2 SS, lateral surface with 6 SS, superior margin with 3 sensillate RS and 6 SS, distally with 5 penicillate setae; ischium length 4.7 times width, inferior margin with 1 SS and 8 sensillate RS, lateral surface with 4 sensillate RS, superior margin with 9 sensillate RS, distally with 11 sensillate RS; merus length 3.8 times width, inferior margin with 6 sensillate RS, lateral surface with 2 sensillate RS, superior margin with 7 sensillate RS; carpus length 10.6 times width, inferior margin with 17 sensillate RS and 1 SS, lateral surface with 1 SS and 13 sensillate RS, superior margin with 1 penicillate seta, 14 SS and 18 sensillate RS; propodus length 12.4 times width, inferior margin with 14 sensillate RS, lateral surface with 5 SS and 6 sensillate RS, superior margin with 9 SS, 1 penicillate seta and 10 sensillate RS; dactylus length 5.4 times proximal width, inferior margin with 3 sensillate RS and 4 SS, superior margin with 6 SS.

Pereopod 5 basis length 3.4 times width, inferior margin with 11 SS, lateral surface with 9 sensillate RS and 27 SS, superior margin with 5 penicillate setae and 2 SS; ischium length 2.2 times width, inferior margin with 7 sensillate RS and 9 SS, lateral surface with 14 SS; merus length 1.2 times width, inferior margin with 7 SS, distosuperior margin with 1 short plumose setae; carpus 2.4 times as long as wide, distosuperior margin with 1 SS; propodus length 2.4 times width, lateral surface with 12 SS, superior margin with 1 sensillate RS and 1 penicillate seta; dactylus length 3.1 times proximal width, with 4 SS.

Pereopod 6 basis length 4.9 times width, inferior margin with 8 SS and 4 plumose setae, lateral surface with 4 plumose setae and 25 SS, superior margin with 1 SS and row of plumose setae; ischium length 1.9 times width, inferior margin with 8 sensillate RS and 4 SS, lateral surface with 12 SS and 3 sensillate RS; merus length 1.3 times width, inferior margin with 7 SS, lateral surface with 1 SS; carpus length 1.2 times width, distosuperior margin with 1 sensillate RS; propodus length 3.1 times width, distoinferior margin with 2 SS, lateral surface with 7 SS, distosuperior margin with 1 SS and 1 penicillate seta; dactylus length 3.4 times proximal width, inferior margin with 1 SS, lateral surface with 1 SS and superior margin with 2 SS.

Pereopod 7 basis length 6.3 times width, inferior margin with 8 SS, lateral surface with 6 SS, superior margin with 8 SS; ischium length 2.2 times width, inferior margin with 6 SS; merus length 1.1 times width, inferior margin with 3 SS, distosuperior margin with 1 SS and 1 short plumose seta; carpus length 2.3 times width, distosuperior margin with 1 SS; propodus length 5.2 times width, distoinferior margin with SS, lateral surface with 4 short SS, distosuperior margin with 4 SS; dactylus length 3.4 times proximal width, with 4 SS.

Operculum length 2.8 times proximal width, distally with medial excision and veined lamellar extension, medial keel with row of RS and SS, surface with scattered SS, margins anterolaterally with 4 SS, laterally with numerous plumose setae. Pleopod 3 endopod length 1.5 times width, with 6 long plumose setae; exopod with 4 long plumose setae and 1 SS. Pleopod 4 endopod length 1.4 times width. Pleopod 5 length 1.8 times width.

Uropod protopod length 1.7 times width, lateral margin with 6 SS and 12 plumose setae, distal margin with 4 SS and 3 plumose setae, surface with 13 scattered SS; exopod length 0.2 times protopod length, with 2 SS; endopod length 0.3 times protopod length, with 2 penicillate setae and 3 SS.

Male. Antenna 1 of 28 articles; article 1 length 1.4 times width, lateral margin with 1 SS, surface with 1 penicillate seta, distomesial corner with 3 sensillate RS and 1 penicillate seta; article 2 length 0.6 times that of article 1, distal margin with 3 sensillate RS, distal extension with 3 penicillate setae; article 3 with 1 SS; article 4 with 2 penicillate setae; terminal article with 2 SS and 1 penicillate seta. Antenna 2 article 1 missing, article 2 damaged, with 2 SS; article 3 with 3 sensillate RS, scale with 3 RS; article 4 with no ornamentation; article 5 longer than articles 1–4, mesial margin with 12 sensillate RS, surface with 9 RS, lateral margin with 13 sensillate RS and 1 penicillate seta, distal margin with 1 sensillate RS; article 6 longer than article 5, mesial margin with 11 sensillate RS, surface with 38 sensillate RS, lateral margin with 15 sensillate RS; flagellum of 31 articles, each setose.

Pleopod 1 length 4.2 times proximal width, ventral surface with 37 SS and 8 sensillate RS, distal lobes with 8 SS. Male pleopod 2 protopod length 2.1 times width, lateral margin with 2 SS and row of plumose setae, surface with 6 SS, distally with lamellar extension; exopod elongate and hooked, length 0.1 times protopod length; stylet short, length 0.4 times protopod length, terminating to a point; sperm duct length 0.3 times stylet length.

Remarks. Epikopais poorei sp. nov. is distinguished from all other species in this genus by: body dorsally covered with setae; small anterolateral cephalic flanges; a small seta on the mandible in the approximate location of the palp; elongate operculum keel and an elongate uropodal protopod. *E. poorei* sp. nov. is further distinguishable from *E. waringa* sp. nov. and *E. mystax* sp. nov. as this species does not have any elongate setae on the frons above the labrum and the endopod of pleopod 3 has many more plumose setae than found in the other two species.

Distribution. South-eastern Australia, from Nowra, NSW to south of Point Hicks, Victoria, from depths between 400–930 m.

Etymology. For Gary Poore, who was my undergraduate honours supervisor between 2000–2001 and was the first to introduce me to asellote isopods.

Epikopais mystax sp. nov.

Figures 6–7

Material examined. All off South Island, New Zealand. Holotype. Female (3.0 mm), Bounty Trough, stn S151, 45°45.8'S, 174°30.5'E, epibenthic sled, 26 September 1979, 1586 m, RV *Tangaroa* (NIWA 23790). Paratypes. Female (2.7 mm, dissected), Bounty Trough, stn S153, 45°21.1'S, 173°35.8'E, epibenthic sled, 27 September 1979, 1386 m, RV *Tangaroa* (NIWA 23791). Female (undissected), type locality (NIWA 23792).

Description. Female. Body length 2.1 times width of pereonite 2; cuticle not highly calcified. Cephalon smooth; anterior

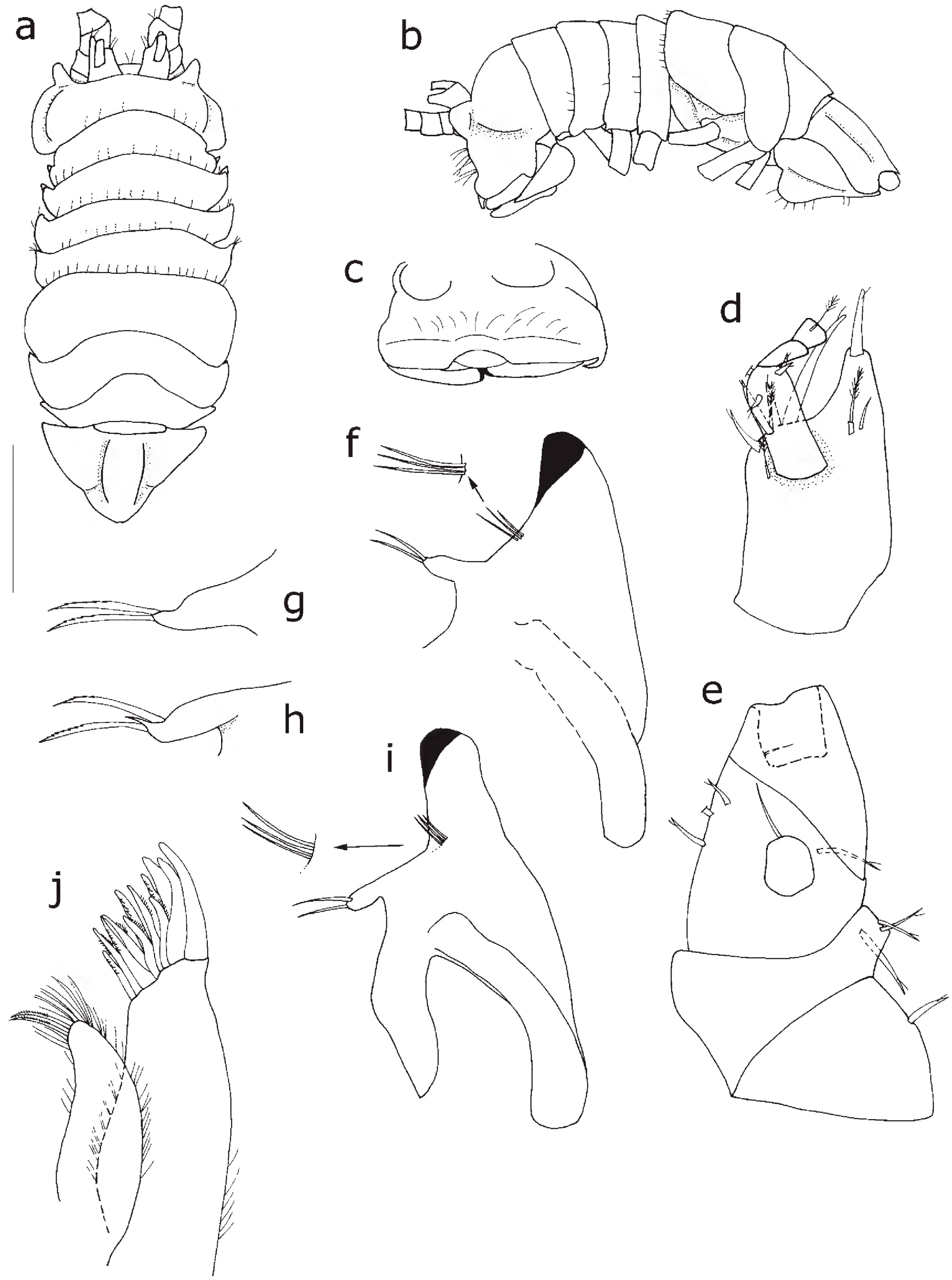

Figure 6. *Epikopais mystax* gen. nov., sp. nov. a–c, female holotype, 3.0 mm (NIWA 23790); d–j, female paratype, 2.7 mm (NIWA 23791): a, dorsal view; b, lateral view; c, cephalon; d, right antenna 1; e, right antenna 2; f, left mandible; g, left mandibular molar; h, right mandibular molar; i, right mandible; j, left maxilla 1. Scale bar = 1 mm, for dorsal and lateral views only.

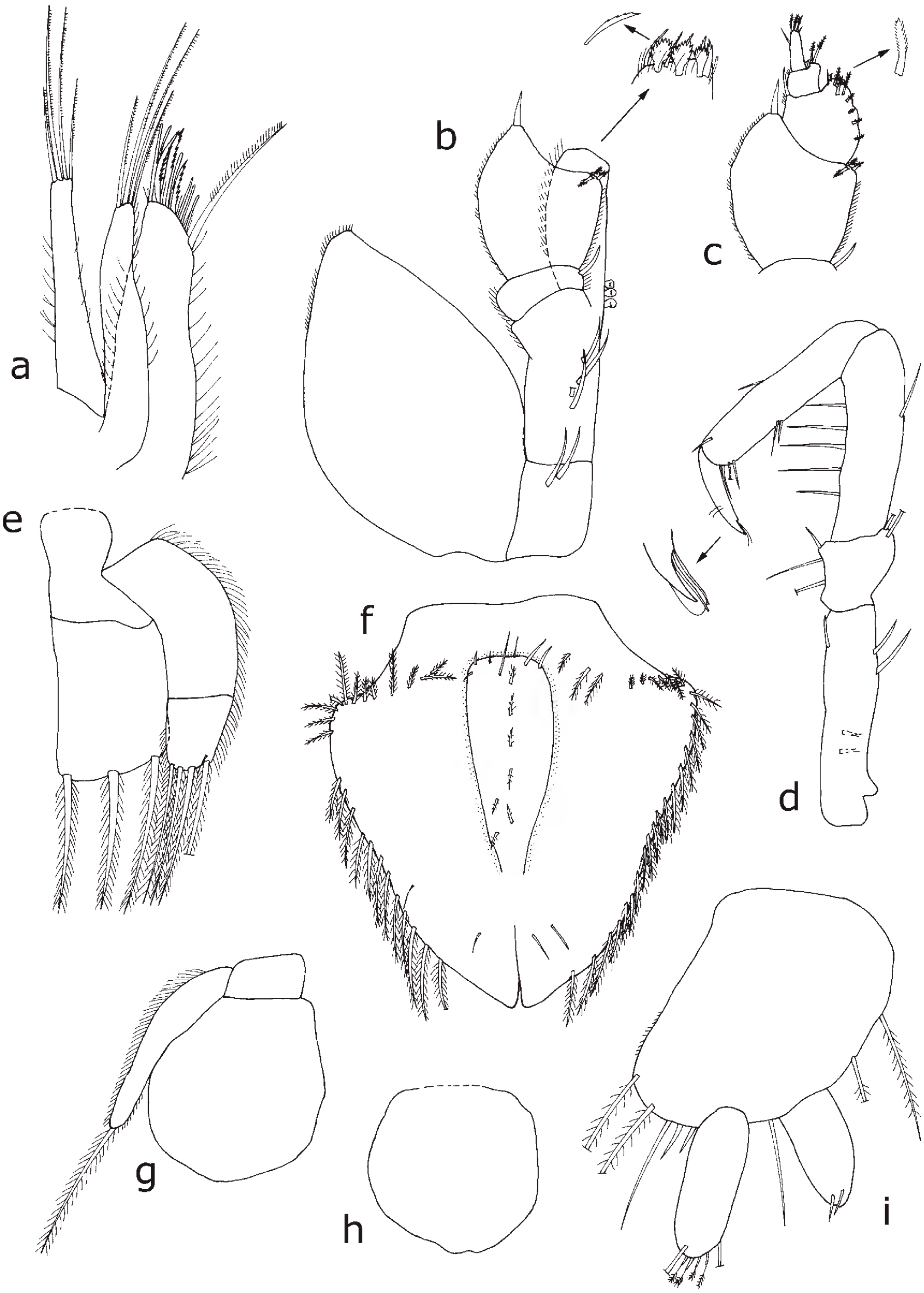

Figure 7. *Epikopais mystax* gen. nov., sp. nov. a–c, e, g, h, female paratype, 2.7 mm (NIWA 23791); d, f, i, female holotype, 3.0 mm (NIWA 23790): a, right maxilla 2; b, right maxilliped; c, right maxilliped palp; d, left pereopod 1; e, left pleopod 3; f, operculum; g, right pleopod 4; h, left pleopod 5; i, right uropod.

cephalic flanges flap-like. Frons with long SS. Pereonites 1–5 anterior margins with SS; anterolateral margins of pereonites 3–4 with anteriorly facing lobes. Pereonite 6 and 7 ventrally without ornamentation. Pleon length 0.7 times proximal width.

Antenna 1 article 1 length 2.1 times width, distal end with narrow extension, surface with 2 penicillate setae and 1 SS, distal margin with 5 sensillate RS and 1 penicillate seta; article 2 length 0.4 times article 1 length, distally with 4 sensillate RS; article 4 with 1 penicillate seta. Antenna 2 article 1 lateral margin with 1 sensillate RS; article 2 length equals article 1 length, distolateral margin with 3 sensillate RS; article 3 length 1.4 times article 1 length, with 4 sensillate RS, scale with 1 SS; article 4 length 1.3 times article 1 length, with 1 SS.

Mandible spine row present, with 3 short spines; molar distally with 2 serrate setae; right molar with distal denticle. Maxilla 1 lateral and mesial margins with fine SS; lateral lobe width 1.5 times mesial lobe width, distal margin with few fine SS, 3 RS, 4 dentate RS, 4 pectinate RS, and 1 bi-serrate RS, mesial lobe distally with many fine SS and 2 long pectinate setae. Maxilla 2 lateral lobe margins with fine SS; middle lobe width equals lateral lobe width; mesial lobe width 2.0 times lateral lobe width, mesial and distal margins with fine SS, distally also with 6 blunt SS, 3 toothed setae and 1 long pectinate seta. Maxilliped coxa rectangular, length 1.3 times width, and 0.3 times basis length, with 2 RS; basis length 3.6 times width, with 4 RS; endite with 3 coupling hooks, 4 toothed setae, 4 fan setae and few fine SS; palp article 1 with cuticular scales, distomesial margin with 1 RS; article 2 length 4.4 times article 1 length, lateral margin with cuticular scales and 1 distal RS, mesial margin with 3 distally pappose setae; article 3 length 2.3 times article 1 length, lateral margin with 1 RS, mesial margin with 2 SS and 7 distally pappose setae; article 4 length 0.9 times article 1 length, with 2 distally pappose setae; article 5 length 1.1 times article 1 length, lateral margin with 1 SS distally with 3 distally pappose setae and 1 SS; epipod length 1.6 times width, margins with cuticular scales.

Pereopod 1 broken; ischium length 4.1 times width, inferior margin with 1 SS, lateral surface with 2 sensillate RS (on opposable surface), superior margin with 2 RS; merus length equals width, inferior margin with 3 SS, distosuperior margin with 2 SS; carpus length 3.4 times width, inferior margin with 5 SS, superior margin with 1 SS; propodus length 4.3 times width, inferior margin with 5 SS, superior margin with 2 SS; dactylus length 3.8 times proximal width, superior margin with 2 SS.

Operculum length 2.1 times proximal width, distally with medial excision and veined lamellar extension, medial keel with row of short, plumose setae, proximally with 7 SS, distal surface with few scattered SS, lateral margins with numerous plumose setae, extending proximally towards keel. Pleopod 3 endopod length 1.4 times width, with 3 long plumose setae; exopod with 4 long plumose setae and 1 SS. Pleopod 4 endopod length 1.2 times width. Pleopod 5 length equals width.

Uropod protopod length 1.3 times width, margins with cuticular scales, lateral margin with 2 plumose setae, distal margin with 4 SS and 2 plumose setae; exopod 0.4 times protopod length, with 2 SS; endopod 0.6 times protopod length, with 5 penicillate setae and 2 SS.

Males are not known from this species.

Remarks. *Epikopais mystax* sp. nov. is distinguished from the other species of *Epikopais* by: the length of pereonites 1–4 being more elongate when compared to the natasome than seen in the other species of this genus; a row of simple setae along anterior margin of pereonite 5; and the frons with numerous long setae. *E. mystax* sp. nov. is most similar to *Epikopais waringa* sp. nov., but differs on several features. *E. mystax* sp. nov. has many more elongate setae on the frons and the body is much narrower than in *E. waringa* sp. nov. Pereonites 1–4 are more elongate in comparison to pereonites 5–7 in *E. mystax*, while in *E. waringa* sp. nov. pereonites 1–4 are shorter in comparison to pereonites 5–7. The operculum keel of *E. mystax* sp. nov. is more elongate and less triangular than in *E. waringa* sp. nov.

Distribution. Bounty Trough, South Island, New Zealand, between 1386–1586 metres.

Etymology. Mystax is Greek, meaning hair on the upper lip, in reference to the many long setae present on the frons.

Epikopais waringa sp. nov.

Figures 8–11

Material examined. All material from south-eastern Australia. Holotype. Female (2.0 mm), off Freycinet Peninsula, Tas., stn SLOPE 47, 41°58.60'S, 148°38.80'E, 27 July 1986, WHOI epibenthic sled, 500 m, RV *Franklin*, coarse shell (NMV J18860). Paratypes. 1 female (2.0 mm), type locality, (NMV J54113). 1 male (1.5 mm, dissected), south of Point Hicks, Vic., stn SLOPE 34, 38°16.40'S, 149°27.60'E, 23 July 1986, WHOI epibenthic sled, 800 m RV *Franklin*, (NMV J18859).

Additional material. 1 female, south of Point Hicks, Vic., stn SLOPE 32, 38°21.90'S, 149°20.0'E, 23 July 1986, WHOI epibenthic sled, 1000 m RV *Franklin* (NMV J18858).

Description. *Female*. Body length 1.6 times pereonite 2; cuticle not highly calcified, smooth. Cephalon anterior margins with few scattered setae; anterior cephalic flanges flap-like. Pereonites 1–4 anterior margins with SS, pereonite 5 anterior margin smooth; anterolateral margins of pereonites 3 and 4 with small lobes; pereonites 6 and 7 ventrally with no ornamentation. Pleon length 0.7 times proximal width, with scattered SS.

Antenna 1 of 8 articles; article 1 with distal extension, length 1.8 times width, distal margin with 1 RS, 2 SS and 1 penicillate seta, distal extension with 1 penicillate seta; article 2 length 0.5 times article 1 length, distal margin with 2 penicillate setae; article 4 with 2 penicillate setae; terminal article with 1 SS and 1 aesthetasc.

Operculum length 4.1 times proximal width, medial keel wide, flat, rounded, with few plumose setae and laterally with many fine SS, distal surface with 1 plumose seta and few scattered SS, distally with medial excision, margins anterolaterally with 5 sub-marginal SS (2+3), laterally with numerous plumose setae.

Male. Antenna 1 of 31 articles; article 1 length 1.6 times width, distal margin with 3 sensillate RS, 1 penicillate seta and 1 SS, distal extension with 1 sensillate RS; article 2 length 0.5 times article 1 length, distal margin with 2 penicillate setae; article 3 with 1 SS; article 4 with 2 penicillate setae; article 7 with 1 SS; terminal article with 1 SS and 1 aesthetasc.

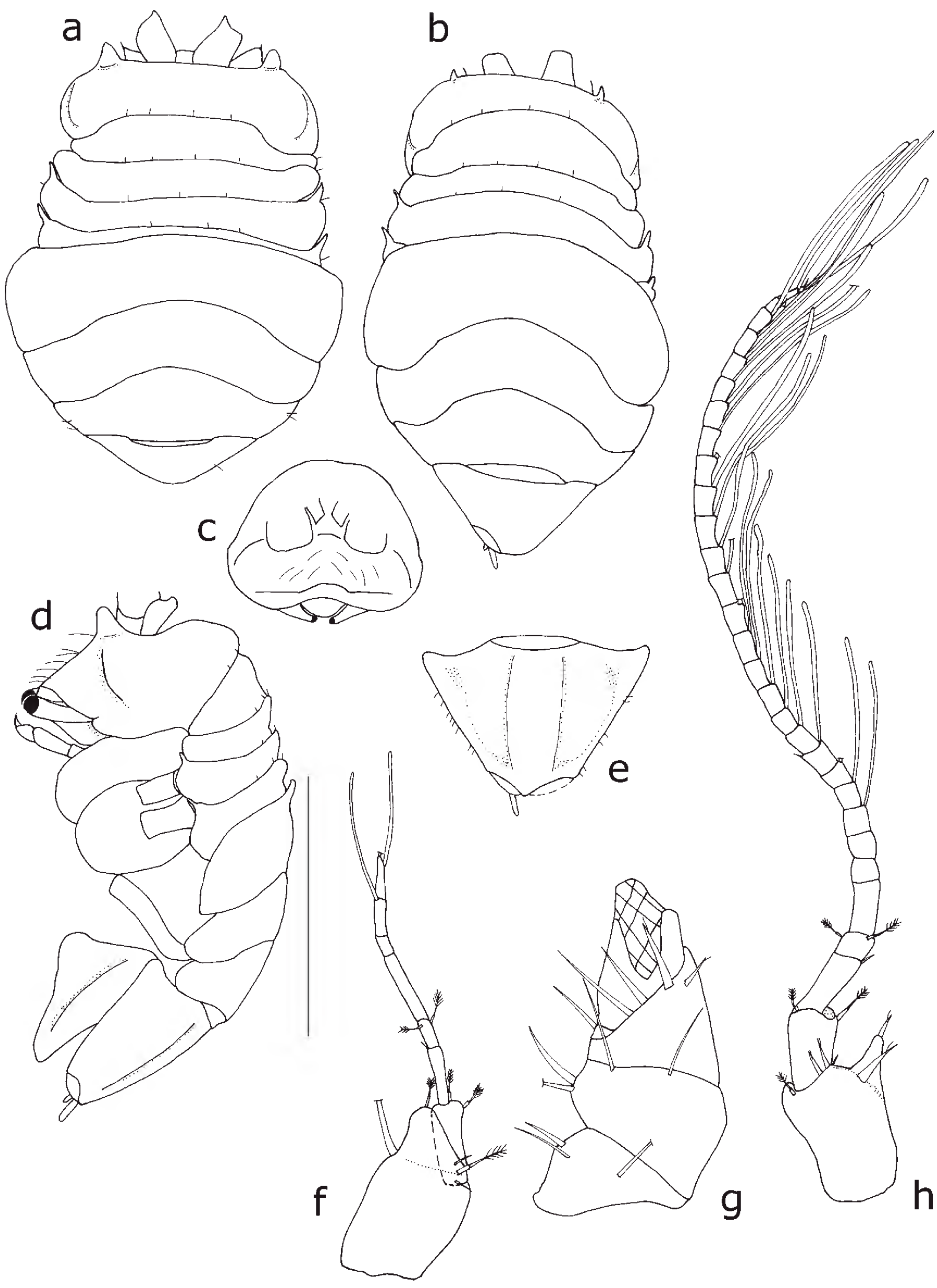

Figure 8. *Epikopais waringa* gen. nov., sp. nov. a–e, female holotype, 2.0 mm (NMV J18860); f, female paratype, 2.0 mm (NMV J54113); g, h, male paratype, 1.5 mm (NMV J18859): a, dorsal view, natasome curled under; b, dorsal view, natasome flat; c, cephalon; d, lateral view; e, dorsal view of pleon; f, left antenna 1; g, right antenna 2; h, left antenna 1. Scale bar = 1 mm, for dorsal and lateral views only.

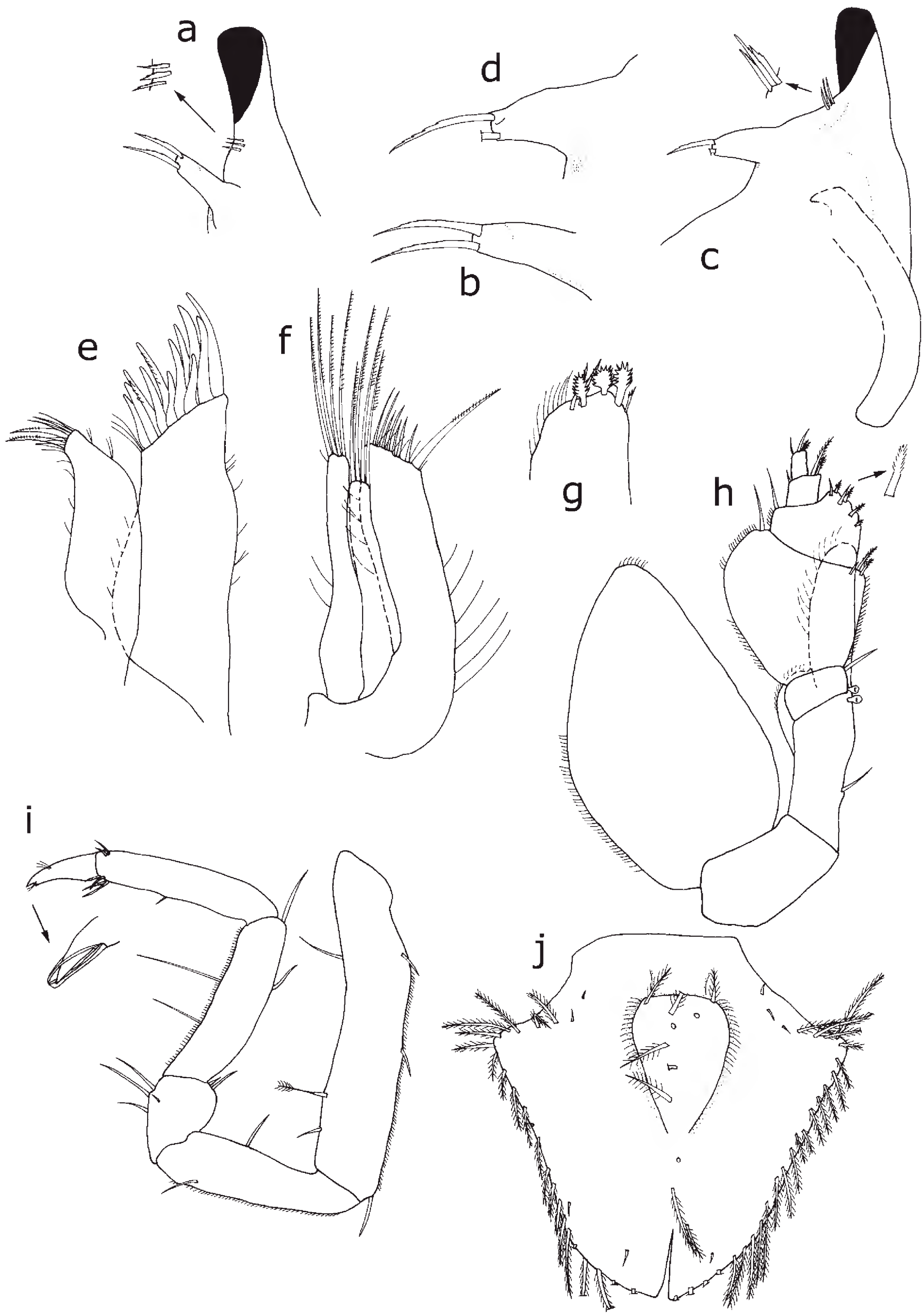

Figure 9. *Epikopais waringa* gen. nov., sp. nov. a–i, male paratype 1.5 mm (NMV J18859); j, female paratype, 2 mm (NMV J54113): a, right mandible; b, right mandibular molar; c, left mandible; d, left mandibular molar; e, left maxilla 1; f, right maxilla 2; g, right maxilliped endite; h, right maxilliped; i, left pereopod 1; j, operculum.

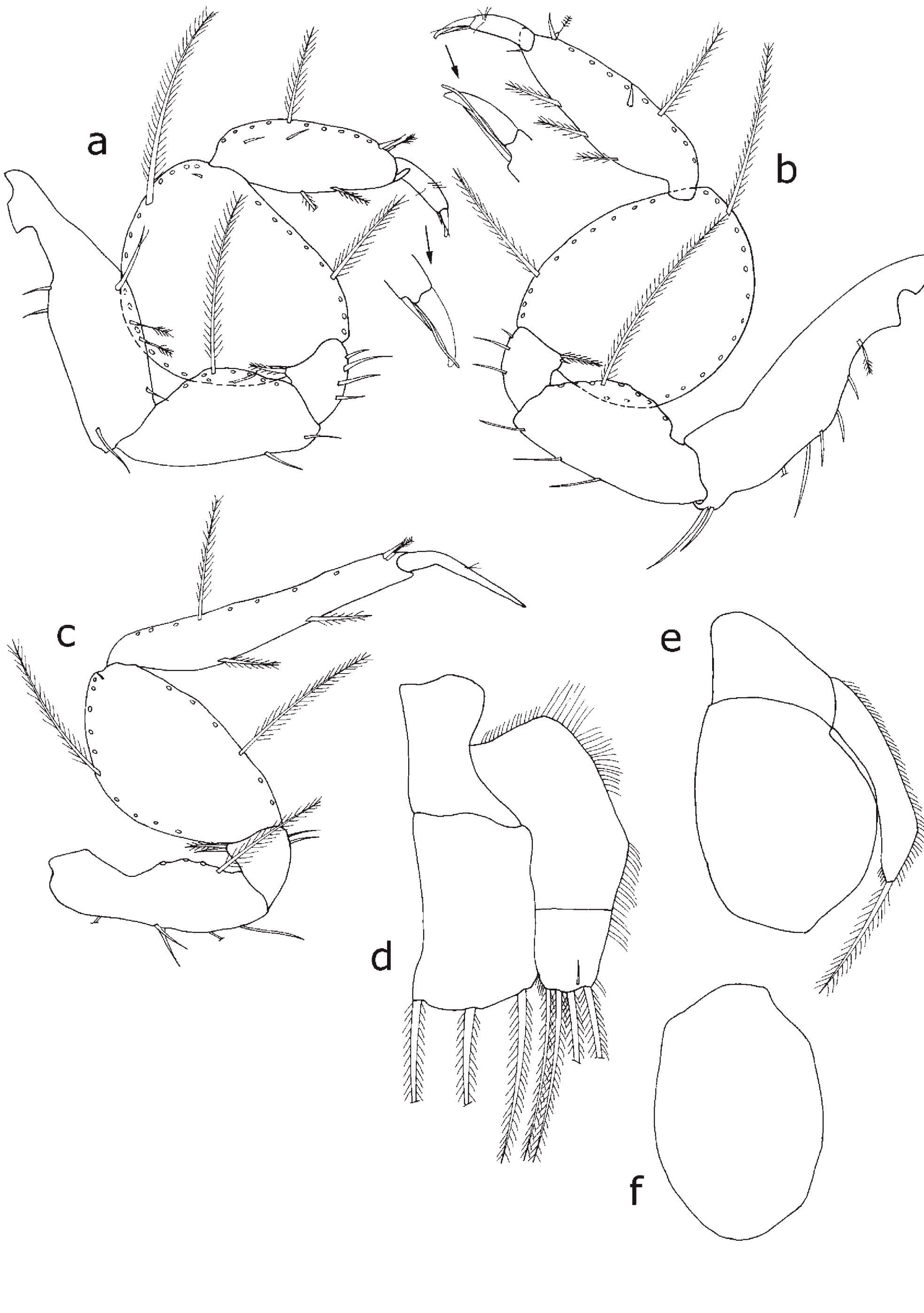

Figure 10. *Epikopais waringa* gen. nov., sp. nov. All figures from male paratype, 1.5 mm (NMV J18859): a, right pereopod 5; b, left pereopod 6; c, right pereopod 7; d, left pleopod 3; e, right pleopod 4; f, left pleopod 5.

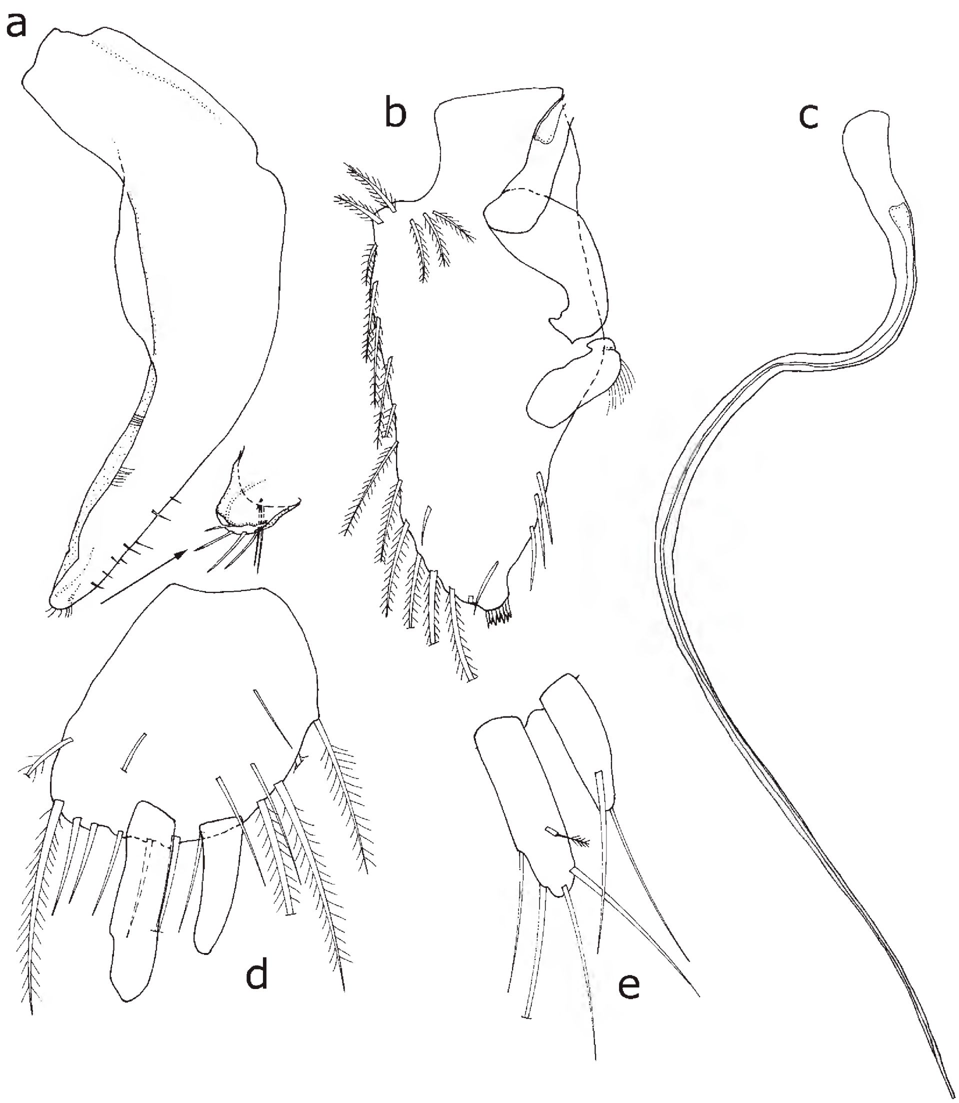

Figure 11. *Epikopais waringa* gen. nov., sp. nov. All figures from male paratype, 1.5 mm (NMV J18859): a, male pleopod 1; b, left pleopod 2; c, left pleopod 2 stylet; d, left uropod; e, endopod and exopod of left uropod.

Antenna 2 damaged; article 1 lateral margin with 1 RS, surface with 2 SS; article 2 length 1.3 times article 1 length, distolateral margin with 2 RS distally with 2 SS; article 3 length 1.4 times article 1 length with 2 sensillate RS and 3 RS along distal rim, scale with 1 RS; article 4 length 1.7 times article 1 length, with no ornamentation.

Mandible spine row present, with 3 short spines; molar distally with 2 serrate setae. Maxilla 1 lateral and mesial margins with fine SS; lateral lobe width 1.5 times mesial lobe width, distal margin with few fine SS, 10 RS and 2 dentate RS, mesial lobe distally with 3 SS, few fine SS and 2 long pectinate setae. Maxilla 2 lateral lobe margins with fine SS; middle lobe as wide as lateral lobe; mesial lobe width 1.7 times lateral lobe width, mesial and distal margins with fine SS, distally with 7 setae (unable to identify type) and 1 long pectinate seta. Maxilliped coxa length 1.7 times width, and length 0.5 times basis length; basis length 4.2 times width, with 1 SS; endite with 2 coupling hooks, 2 toothed setae, 4 fan setae and few fine SS; palp article 1 distomesial margin with 1 SS; article 2 length 4.2 times article 1 length, lateral margin with cuticular scales

and 1 SS, mesial margin with 2 distally pappose setae and 1 SS; article 3 length 1.9 times article 1 length, lateral margin with 1 SS, mesial margin with 2 SS and 4 distally pappose setae; article 4 length 0.8 times article 1 length, lateral margin with 1 SS and 2 distally pappose setae; article 5 length 0.6 times article 1 length, with 2 SS and 2 distally pappose setae; epipod length 1.6 times width, margins with cuticular scales.

Pereopod 1 basis length 4.6 times width, inferior margin with cuticular scales, and 3 SS, superior margin with 2 SS and 1 penicillate seta; ischium length 3.5 times width, inferior margin with 1 SS and cuticular scales, superior margin with 1 SS; merus length 1.3 times width, inferior margin with 3 SS, lateral surface with 1 SS, distosuperior margin with 2 SS; carpus length 3.6 times width, inferior margin with 2 SS and cuticular scales, superior margin with 2 SS; propodus length 4.9 times width, inferior margin with 5 SS (4 distally), distosuperior margin with 2 SS; dactylus length 2.6 times proximal width, distosuperior margin with 3 SS.

Pereopod 5 basis length 3.0 times width, inferior margin with 3 SS, superior margin with 1 sensillate RS, 2 penicillate setae and 1 SS; ischium length 1.8 times width, inferior margin with 2 SS, superior margin with 1 SS; merus length 1.3 times width, inferior margin with 4 SS, distosuperior margin with 1 SS and 1 plumose seta; carpus length 1.3 times width, lateral surface with 1 SS; propodus length 2.5 times width, lateral surface with 2 SS, distosuperior margin with 1 sensillate RS and 1 penicillate seta; dactylus length 2.7 times proximal width, with 4 small SS.

Pereopod 6 basis length 3.7 times width, inferior margin with 7 SS and 1 penicillate seta; ischium length 1.9 times width, inferior margin with 3 SS; merus length 1.4 times width, inferior margin with 3 SS, distosuperior margin with 1 SS and 1 plumose seta; carpus length 1.1 times width; propodus length 2.9 times width, distally with 1 SS, superior margin with 2 RS and 1 penicillate seta; dactylus length 3.1 times proximal width, with 4 small distal SS.

Pereopod 7 basis missing; ischium length 2.9 times width, inferior margin with 5 SS; merus length 1.3 times width, inferior margin with 2 SS, distosuperior margin with 1 plumose setae and 1 SS; carpus length 1.7 times width, distosuperior margin with 1 SS; propodus length 5.2 times width, distosuperior margin with 1 sensillate RS and 1 penicillate seta; dactylus length 7.1 times proximal width, superior margin with 2 SS; unguis damaged.

Male pleopod 1 length 6.7 times proximal height, central margin with 8 SS, distally with 7 SS. Male pleopod 2 protopod length 2.2 times width, lateral margin with row of plumose setae, surface with 2 SS, distally with lamellar extension, mesial margin with 3 SS; exopod length 0.2 times protopod length with fine SS; stylet long, hooked up into protopod, length 2.5 times protopod length; sperm duct length 0.8 times stylet length. Pleopod endopod length 1.5 times width, with 3 long plumose setae; exopod with 4 long plumose setae and 1 SS. Pleopod 4 endopod length 1.3 times width. Pleopod 5 length 1.5 times width.

Uropod protopod length 1.3 times width, lateral margin with 3 plumose setae, distal margin with 1 plumose setae and 6 robust SS, mesial margin with 1 plumose seta, surface with 3 SS; exopod length 0.5 times protopod length, with 2 SS; endopod length 0.7 times protopod length, with 4 SS and 1 penicillate seta.

Remarks. Epikopais waringa sp. nov. is defined by: the wide body, which is about 0.7 times as wide as long; anterior margins of pereonites 1–4 with few simple setae; and the triangular operculum keel. For further discussion refer to the comments for *E. mystax* sp. nov.

Distribution. South-eastern Australia, from Point Hicks, Victoria to Freycinet Peninsula, Tasmania, between 500 and 1000 metres.

Etymology. Waringa is an Aboriginal word meaning sea; noun in apposition.

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New species of *Brucerolis* (Crustacea: Isopoda: Serolidae) from seas around New Zealand and Australia

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Abstract

Storey, M.J., and Poore, G.C.B. 2009. New species of *Brucerolis* (Crustacea: Isopoda: Serolidae) from seas around New Zealand and Australia. *Memoirs of Museum Victoria* 66: 147–173.

Five new species of *Brucerolis* Poore and Storey, 2009 are described, four from deep waters off New Zealand and one from south-eastern Australia. This doubles the number of species in the genus. Seven species are now known from the Tasman Sea and eastern New Zealand, and three from within or close to the Southern Ocean. A key to all species is presented.

Keywords Crustacea, Isopoda, Serolidae, *Brucerolis*, taxonomy, New Zealand, Australia, new species

Introduction

Poore and Storey (2009) erected the genus *Brucerolis* to distinguish a group of five species of serolid isopods that had previously been confused with *Acutiserolis* Brandt, 1988 by isopod workers who adopted Brandt's (1988 and 1991) revision (e.g., Wägele, 1994; Poore and Brandt, 1997; Held, 2000). *Brucerolis* differs from *Acutiserolis* in having the coxal dorsal plates 2–6 interacting only by means of key-like lobes, coxal plate 6 exceeding the pleotelson by at least the pleotelson length, middorsal spines being absent or obscure, and the pleotelson lacking ridges and keels. The type species, *Brucerolis nowra* Poore and Storey, 2009 is from the continental margin of eastern Australia but is not the only species there. Here, another is described along with four more from seas around New Zealand where they have been collected in their hundreds.

One of the species included by Poore and Storey in *Brucerolis* was *Serolis bromleyana* Willemöes-Suhm, 1876. Hurley (1957) identified deepwater isopods collected from Cook Strait and off the eastern coast of New Zealand as *Serolis bromleyana*. Later, Hurley (1961a) reported the same species from the Tasman Sea, but the specimen illustrated in his plate 1 (p. 226) differed from Antarctic specimens described by Beddard (1884a). Hurley (1961b) summarised these findings in a checklist and key to New Zealand isopods. In a subsequent correspondence with one of us (letter to GCBP, 16 May 1984), Hurley discussed three forms that he could clearly distinguish by depth distribution and colour. The three are described as new species here. Surveys of the epibenthic macrofauna on the Chatham Rise, New Zealand, indicated three communities, the shallowest of which at 237–602 metres and predominantly sandy sediments is characterised by crustaceans, including "*Serolis bromleyana*" (McKnight and Probert, 1997). Hurley was not the first author to have commented on the morphological variability of specimens similar to *Serolis bromleyana*. Beddard (1884a: pl. 4 figs 3, 6) illustrated a male from New Zealand that, he noted, differed from syntypes of *S. bromleyana* from the Indian Ocean sector of the Southern Ocean in the shape and length of coxa 6, acute rather than emarginate epimeron apices, less pronounced marginal and transverse ridges and lack of anterior spine on pereonite 1 and the presence of fine setae on the ischium, merus and carpus of the male pereopod 2.

Poore and Brandt (1997) illustrated the mouthparts of the syntypes of *Serolis bromleyana*, referred the species to the genus *Acutiserolis* and commented on morphological variation reported in the literature. They stated that material from deep water off southern Australia and New Zealand contained at least three undescribed species. They also reported a *S. bromleyana*-like specimen collected from the West Scotia Basin, Southern Ocean with a long, setose palm and proximal heel of the male pereopod 2 propodus, which they found clearly different from the short palm and median heel of that of the male syntype of *S. bromleyana*. More recently, Held (2000) mentioned the difficulty in placing material of "*Acutiserolis bromleyana*" from the Drake Passage owing to morphological disparity with the description.

In this paper, four new species are described from collections made off New Zealand by the National Institute of Water and Atmosphere, Wellington, New Zealand (NIWA) and one from collections from south-eastern Australia made by Museum Victoria, Melbourne (NMV). Additional material was available from the South Australian Museum (SAM) and the US National Museum of Natural History (USNM). A key is presented for all species of *Brucerolis*.

Adult male and ovigerous female specimens were dissected and examined using a Wild M5 dissecting microscope and an Olympus BX50 and Olympus BH-2 compound microscope and new species were drawn under Nomarski illumination using a camera lucida. Illustrations are of male left limbs unless otherwise noted and are labelled: A1, A2, antenna 1 and 2; MD, MDp, mandible and palp; MX1, MX2, maxilla 1 and 2; MP, maxilliped; P1–P7, pereopods 1–7; PL1–PL5, pleopods 1–5; PS, medial ridge of pleonal sternites; S, pereonal and pleonal sternites of male; U, uropod. Scale bars are 10 mm and refer to habitus drawings only. Body length is measured from the anterior margin of the head to the posterior margin of the pleotelson, excluding the antennae and coxae. Descriptions are essentially of holotype males and differences noted for paratype females. All figures are from the male unless otherwise indicated. Type material is deposited at NIWA, NMV and SAM.

Serolidae Dana, 1853

Brucerolis Poore and Storey, 2009

Key to species of *Brucerolis* Poore and Storey, 2009

The key does not include the two South Atlantic species, *B. maryannae* (Menzies, 1962) or *B. macdonnellae* (Menzies, 1962), both poorly described but apparently similar to *B. bromleyana*.

1. Anterolateral margin of pereonite 1 with acute angle, dorsally with elongate triangular slope connecting to transverse ridge ... *B. bromleyana* (Willemöes-Suhm, 1876)
– Anterolateral margin of pereonite 1 rounded, without acute projection, dorsally with submarginal ridge or elevated area but not a triangular slope ... 2
2. Pleonal epimera 2 and 3 with emarginate bifid apices ... 3
– Pleonal epimera 2 and 3 with acute apices ... 6
3. Dorsal surface of pereonite 1 without an oblique sinuous ridge separated from lateral margin by shallow trough (fig. 1d, f) ... 4
– Dorsal surface of pereonite 1 with an oblique sinuous ridge separated from lateral margin by shallow trough (fig. 1h) or with a sculptured elevated area (fig. 1c) ... 5
4. Anterolateral margin of head obliquely concave, lateral angle considerably more produced anteriorly and elevated than mesial angle; male epimeron 3 well exceeding posterior margin of telson; uropodal endopod 3.5 times as long as wide ... *B. nowra* Poore and Storey, 2009
– Anterolateral margin of head transversely concave, lateral angle only slightly more elevated and produced anteriorly than mesial angle; male epimeron 3 barely reaching posterior margin of telson; uropodal endopod 3.0 times as long as wide ... *B. howensis* sp. nov.
5. Pleonal epimeron 3 equal to (in female) or exceeding pleotelson; anterolateral region of pereonite 1 with narrow sharp submarginal ridge and groove parallel to margin ... *B. victoriensis* sp. nov.
– Pleonal epimeron 3 not exceeding pleotelson; anterolateral region of pereonite 1 with broad submarginal pocked area ... *B. cidaris* (Poore and Brandt, 1997)
6. Anterolateral margins of head straight-concave, lateral angle well produced beyond margin of pereonite 1; width of front (between anterolateral corners) 1.6 times as wide as maximum span between lateral margins of eyes ... *B. brandtae* sp. nov.
– Anterolateral margins of head convex or straight, lateral angle not produced beyond margin of pereonite 1; width of front (between anterolateral corners) less than 1.3 times as wide as maximum span between lateral margins of eyes ... 7
7. Ventral coxal plates 2–4 with transverse ridges on mesial, anterior and posterior margins outlining a transverse depression; coxal plates 6 of male parallel, of female increasingly diverging towards tip; anterolateral corners of head continuous with anterior margin of pereonite 1 ... *B. osheai* sp. nov.
– Ventral coxal plates 2-4 with a prominent tubercle at anteromesial corner; coxal plates 6 initially diverging then converging slightly towards tip; anterolateral corners of head convex but not continuous with anterior margin of pereonite 1 ... *B. hurleyi* sp. nov.

Brucerolis brandtae sp. nov.

Figures 1a, 2–5

Material examined. Holotype: New Zealand, Bounty Plateau, 48°58'S, 178°02'E, 1060 m, 23 Jan 1965 (NIWA stn F114), NIWA 27415 (adult male, 35 mm).

Paratypes: New Zealand, Bounty Plateau, 48°07'S, 174°02'E, 1155 m, 21 Jan 1965 (NIWA stn F110), NIWA 27413 (adult female, 35 mm), NIWA 27410 (1 male, 1 juvenile); 49°18.6–17.5'S, 177°54.7–55.5'E, 990 m, 15 Mar 1981 (NIWA stn T48), NIWA 27414 (adult male, 36 mm), NMV J55313 (8 males, 3 females, 8 juveniles); 48°58'S, 178°02'E, 1060 m, 23 Jan 1965 (NIWA stn F114), NIWA 27411 (1 male, 1 female); 48°32'S, 177°59'E, 1051 m, 27 Jan 1965 (NIWA stn F125), NIWA 27409 (2 males, 2 females, 1 juvenile); 48°30.5–32'S, 178°18–23.8'E, 915 m, 19 Mar 1979 (NIWA stn I697), NIWA 27412 (8 males, 8 females, 10 juveniles); 48°50.6'S, 178°41.5'E, 808 m, 17 Mar 1979 (NIWA stn I689), NIWA 27417 (32 males, 14 females, 22 juveniles).

Other material: numerous specimens from 37 NIWA stations.

Description of male holotype. Body length 35 mm. Body 0.8 times as long as greatest width (at coxae 3). Middorsal line with short triangular middorsal processes on posterior margin of head,

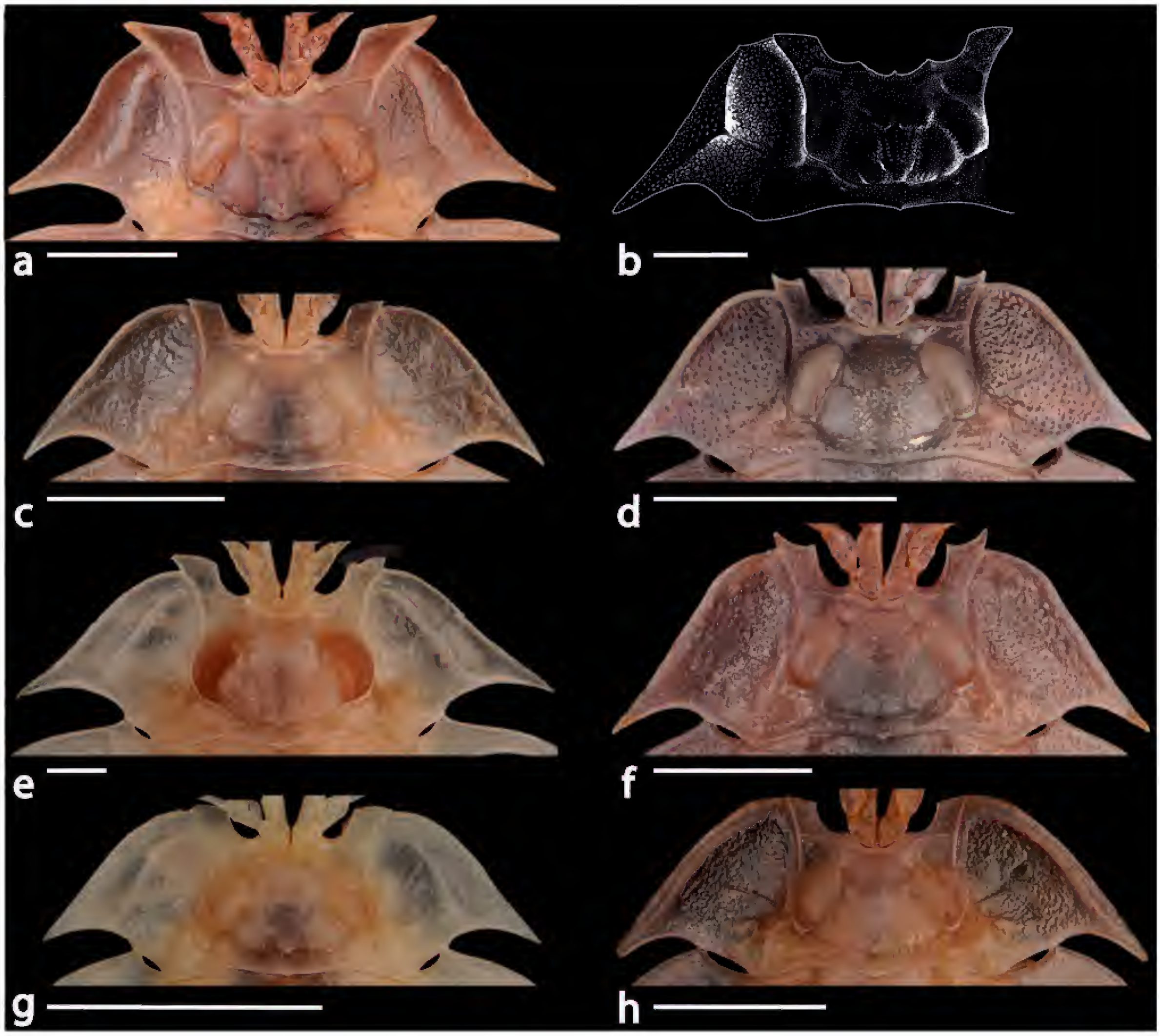

Figure 1. Head and pereonite 1 of species of *Brucerolis*. a, *B. brandtae* sp. nov. (NMV J55313). b, *B. bromleyana* (syntype, BMNH 1889.4.27.20, negative of drawing by Kate Thompson published by Poore & Brandt, 1997). c, *B. cidaris* (NMV J27642). d, *B. howensis* (NMV J55315). e, *B. hurleyi* (NMV J55314). f, *B. nowra* (NMV J19213). g, *B. osheai* (NMV J55316). h, *B. victoriensis* (NMV J19201). Scale bar in each case = 10 mm.

pereonites 2–4 and pleonites 1–3, evident in lateral view. Head, anterolateral margins straight-concave, lateral corners acute and projecting anteriorly; width between anterolateral corners 1.6 times as wide as maximum span between lateral margins of eyes; head with paired strongly projecting curving acute processes on transverse ridge at bases of antennae 1, with prominent paired tubercles between eyes, with small, blunt median posterior tubercle, with obscure lobes lateral to median posterior tubercle. Pereonite 1, lateral margin gently sinuous, lateral margin upturned over anterior half, sharply crested, with sinuous low rounded oblique ridge more or less parallel to margin, separated from it by a shallow concave trough occupying about one-third of width, dorsal surface with obsolete oblique-transverse ridge reaching sinuous ridge. Coxal dorsal plate 2 0.8 times as long as half pereonal tergite 2 width (following plates increasing in length); plate 4 1.9 times as long as half pereonal tergite 4 width; plate 6 extending beyond tip of pleotelson by 2.2 times middorsal length of pleotelson (minimum estimate), the pair diverging and then converging slightly apically, curving evenly; pleonal epimeron 2 2.2 times length of pleotelson; pleonal epimeron 3 1.2 times

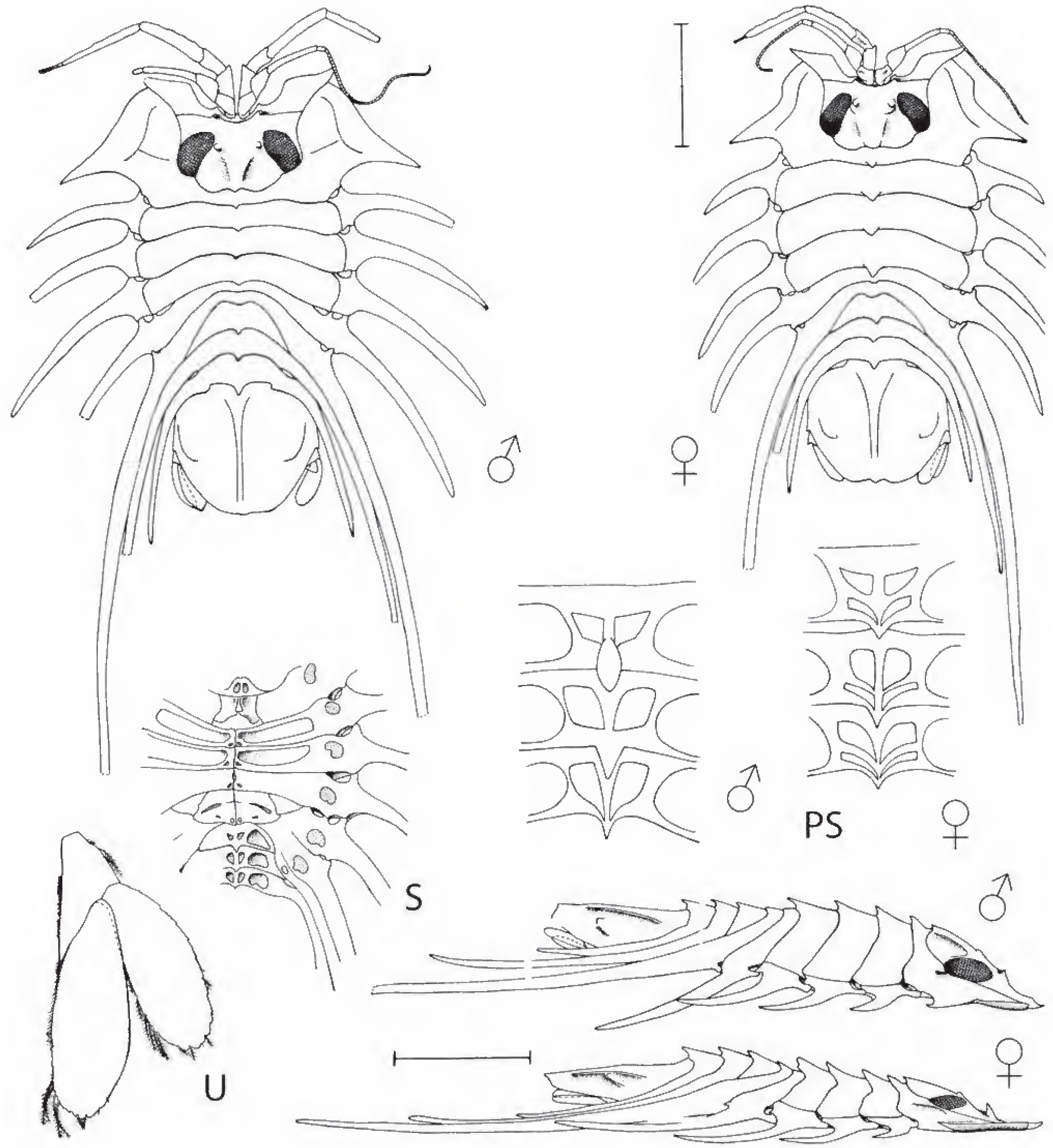

Figure 2. *Brucerolis brandtae* sp. nov. Holotype male (NIWA 27415): dorsal and lateral views, sternites of pereonites 1–7, pleonites 1–3, medial ridge of pleonites 1–3. Paratype female (NIWA 27413): dorsal and lateral views, medial ridge of pleonites 1–3. Paratype male (NIWA 27414): uropod. Scale = 10 mm.

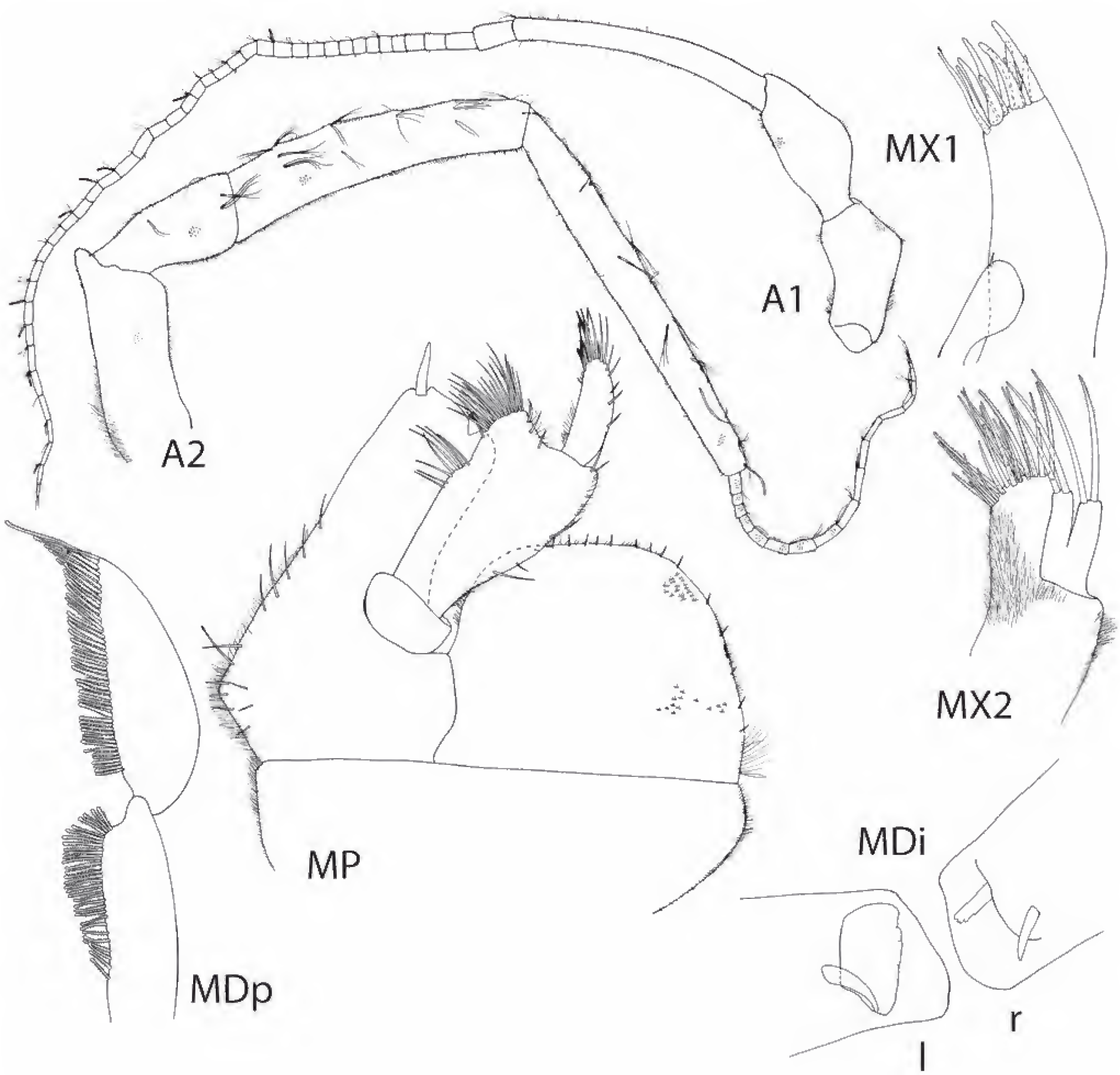

Figure 3. *Brucerolis brandtae* sp. nov. Holotype male (NIWA 27415): antenna 1, mandibular incisors, palp, maxillae 1, 2, maxilliped. Paratype male (NIWA 27414): antenna 2.

length of pleotelson; pleonal epimera 2 and 3 with acute apices. Ventral coxal plates 2–4 with transverse ridges on mesial, anterior and posterior margins outlining a transverse depression. Antenna 1 peduncle articles 3+4 2 times as long as article 2 (anterior margin); flagellum of about 42 articles. Antenna 2 peduncle article 5 1.4 times as long as article 4; flagellum of 18 articles. Pereopod 1 propodus 2.2 times as long as greatest width. Pereopod 2 palm dorsal length 1.8 times greatest width, straight, sharply angled at free proximal margin, with 20 robust setae in U-shaped row. Pereopod 7 carpus 5 times as long as greatest width; propodus 4.5 times as long as greatest width, propodus tapering from near base, lower margin straight; dactylus curved, 0.45 times as long as propodus. Pleopod 2 endopod with convex distal margin, sharply tapering to base of appendix masculina; appendix masculina 3.8 times as long as straight margin of endopod. Uropodal exopod 0.85 length of endopod.

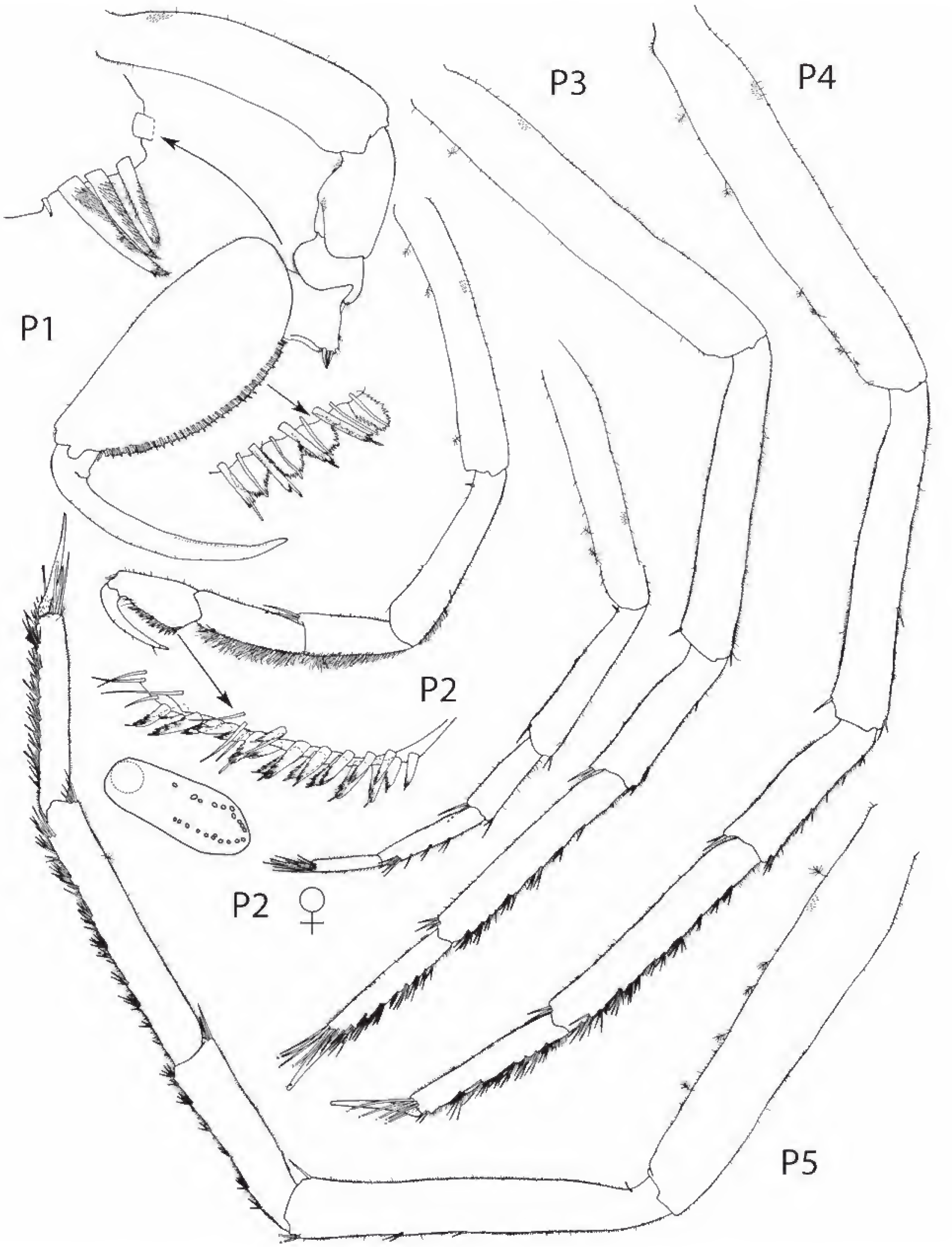

Figure 4. *Brucerolis brandtae* sp. nov. Holotype male (NIWA 27415): pereopods 1–5. Paratype female (NIWA 27413): pereopod 2.

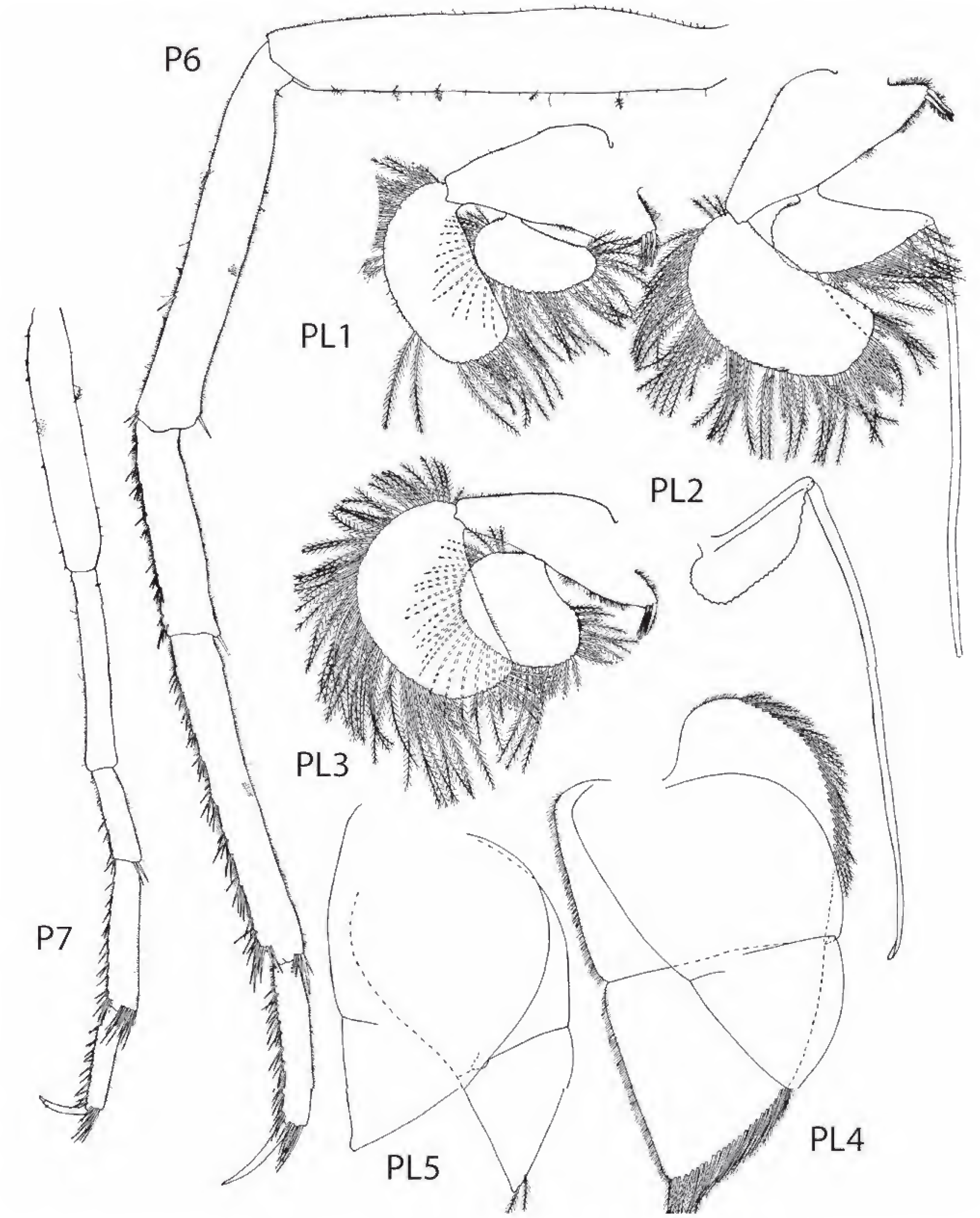

Figure 5. *Brucerolis brandtae* sp. nov. Holotype male (NIWA 27415): pereopods 6, 7, pleopods 1–5. Paratype male (NIWA 27414): pleopod 2 endopod and appendix masculina.

Female. Pereonite 1, lateral margin of female convex anteriorly, with distinct step-like interruption and straight posteriorly. Coxal dorsal plate 2 of female 0.8 times as long as half pereonal tergite 2 width; plate 4 of female 1.4 times as long as half pereonal tergite 4 width (following plates increasing in length); plate 6 of female extending beyond tip of pleotelson by 2 times middorsal length of pleotelson (or more), the pair diverging over entire length, curving evenly.

Size. Male length: 24–40 mm, female length: 27–35 mm.

Distribution. New Zealand, eastern slope, Chatham Rise, Bounty Plateau, northern Campbell Plateau, 39°S–51°S, 167°E–179°W, 494–1500 m. One record NE of North Island, 2500 m, and one record W of South Island.

Etymology. *Brucerolis brandtae* is named for Professor Angelika Brandt, who studied the phylogeny of serolids and described new serolid genera and species.

Remarks. The large size of males and females (up to 40 and 35 mm respectively) of *Brucerolis brandtae* and the wide anterolateral head lobes with a straight or convex anterior margin are useful characters for identifying this species. Like *B. hurleyi* and *B. osheai*, the anterior transverse ridge on the head of *B. brandtae* has a strongly acute, posteriorly curved dorsal projection immediately adjacent to the insertion of antenna 1 on both sides.

Brucerolis bromleyana (Willemöes-Suhm, 1876)

Figure 1b

Serolis bromleyana Willemöes-Suhm, 1876: 591. — Beddard, 1884b: 331. — Beddard, 1884a: 53–57, pl. 4 (except figs. 3, 6). —Sheppard, 1933: 280, 329–330.

Acutiserolis bromleyana. — Brandt, 1988: 17, 21. — Brandt, 1991: 131. — Poore and Brandt, 1997: 153–156, figs. 1–2.

Serolis (*Acutiserolis*) *bromleyana*. — Wägele, 1994: 53.

Not *Serolis bromleyana*.— Beddard, 1884a: pl. 4, figs. 3, 6 (identity uncertain). — Hurley, 1957: 13 (identity uncertain). — Hurley, 1961a: 228–229, pl. 1 (?= *B. hurleyi*). — Hurley, 1961b: 269, 285 (identity uncertain). — McKnight and Probert, 1997: 508 (identity uncertain).

Not *Acutiserolis bromleyana*. — Held, 2000: 167 (identity uncertain).

Brucerolis bromleyana. — Poore and Storey, 2009: 152-153.

Distribution. The type locality and only confirmed record is at 3612 m depth, from a bottom of diatom ooze, 62°26'S, 95°44'E, Southern Indian Ocean.

Remarks. *Brucerolis bromleyana* can be identified by the small acute projection on the anterolateral margins of pereonite 1, the emarginate tips of epimera 2 and 3 and the short, concave palm on the male pereopod 2 propodus. The only other species with a small acute projection on the anterolateral margins of pereonite 1 are *B. maryannae* and *B. macdonnellae*, both from the South Atlantic. *Brucerolis maryannae* can be distinguished from *B. bromleyana* by the serrulate anterior margin of the head and pereonite 1 and by the rounded posterior margin of the pleotelson (that of *B. bromleyana* is concave). *Brucerolis macdonnellae* also has a rounded posterior margin of the pleotelson and also differs from *B. bromleyana* by the acute tips of epimera 2 and 3.

Poore and Brandt (1997: 15, fig. 3) illustrated a male of "*Acutiserolis* sp." that shares with these three species an acute projection on the margin of pereonite 1. It differed in a more erect submarginal ridge and more elongate propodus on pereopod 2 and may well represent another similar species of *Brucerolis* close to or in the Southern Ocean.

Brucerolis cidaris (Poore and Brandt, 1997)

Figure 1c

Acutiserolis cidaris Poore and Brandt, 1997: 157–160, figs. 4–6.

Brucerolis cidaris. — Poore and Storey, 2009: 152-153.

Distribution. Coral Sea, Australia, near Townsville and Chesterfield Islands, 17°12.15'S–21°15.01'S, 147°10.80'E–157°51.33'E, 891–1491 m.

Remarks. *Brucerolis cidaris* is diagnosed by its small size, emarginate tips of epimera 2 and 3 and pock-marked anterolateral region of pereonite 1. *Brucerolis hurleyi* and *B. osheai* are similar to *B. cidaris* but both have a covering of long setules on the lower margin of the male pereopod 2, a dorsal curved acute process on the anterior margin of the head and acute tips of epimera 2 and 3.

Brucerolis howensis sp. nov.

Figures 1d, 6–9

Material examined. Holotype: Tasman Sea, Lord Howe Rise, 34°59.3'S, 162°11.28'E, 1573 m, 26 Sep 1982 (NIWA stn U198 SEB), NIWA 27431 (adult male, 29 mm).

Paratypes: collected with holotype, NIWA 27428 (adult female, 27 mm), NIWA 27428 (adult male, 29 mm), NIWA 27427 (2 males, 7 juveniles), NMV J55315 (1 male, 1 female); Tasman Sea, Lord Howe Rise, 31°34.0'S, 159°26.5'E, 1828–1808 m, 08 May 1979 (NIWA stn I722), NIWA 27428 (1 male, 1 female).

Other material: Tasman Sea, S of Lord Howe Plateau, 37°00'S, 170°00'E, 2096 m, 18 Apr 1970 (NZOI stn J39), NIWA (1 female).

Description of male holotype. Body length 29 mm. Body 1.1 times as long as greatest width (at coxae 3). Middorsal line without midposterior processes, not elevated in lateral view. Head, anterolateral margins concave, lateral corners acute and projecting anteriorly; width between anterolateral corners as wide as maximum span between lateral margins of eyes; head without paired processes on transverse ridge at bases of antennae 1, without paired tubercles between eyes, with small, blunt median posterior tubercle, with obscure lobes lateral to median posterior tubercle. Pereonite 1 lateral margin gently sinuous, lateral margin upturned over anterior half, obscurely duplicated, without submarginal ridge, dorsal surface with oblique-transverse ridge reaching near margin. Coxal dorsal plate 2 0.9 times as long as half pereonal tergite 2 width (following plates increasing in length); plate 4 1.3 times as long as half pereonal tergite 4 width; plate 6 extending beyond tip of pleotelson by 2.3 times middorsal length of pleotelson, the pair diverging over entire length, almost straight except at apex; pleonal epimeron 2 1.7 times length of pleotelson; pleonal

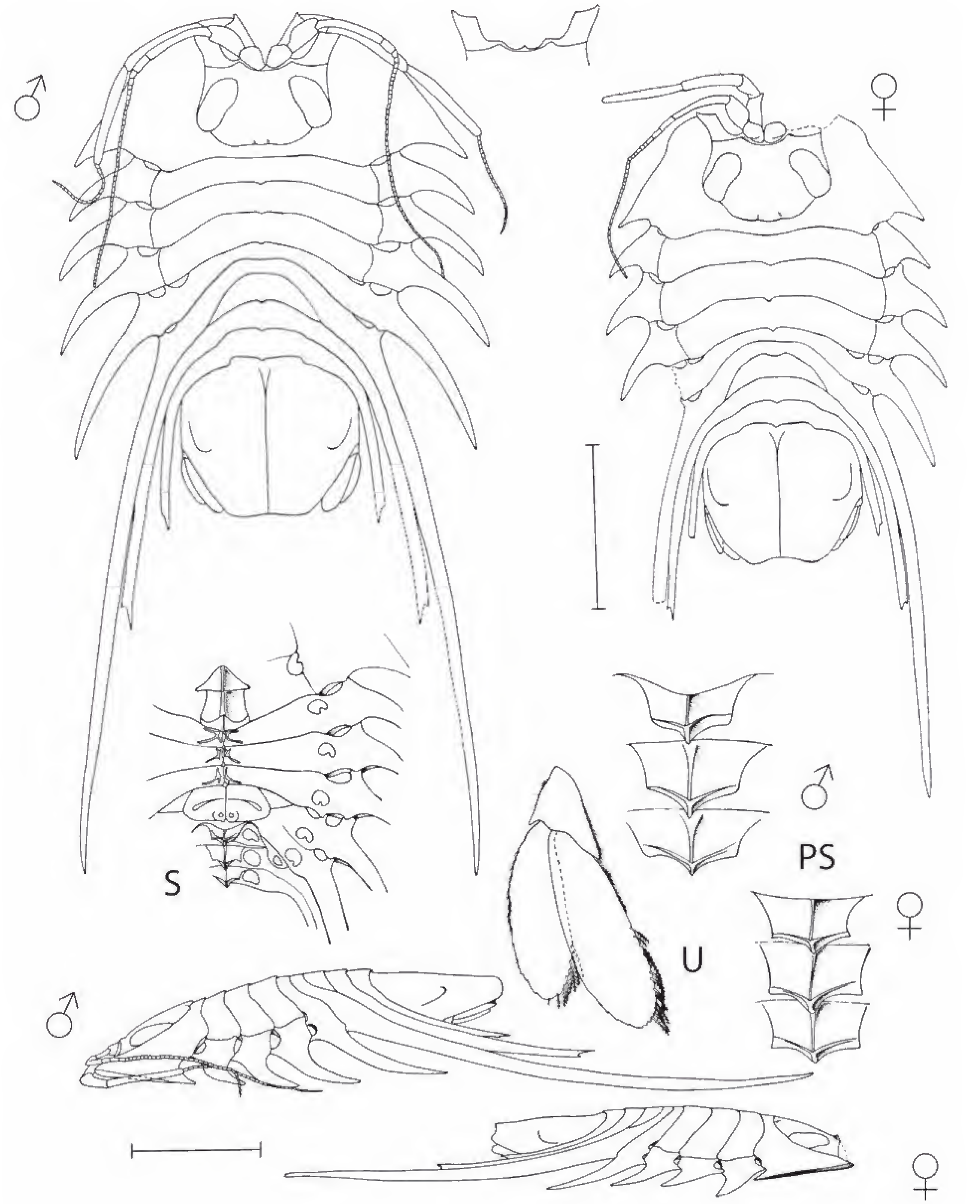

Figure 6. *Brucerolis howensis* sp. nov. Holotype male (NIWA 27431): dorsal and lateral views, detail of front of head, sternites of pereonites 1–7, pleonites 1–3, medial ridge of pleonites 1–3, uropod. Paratype female (NIWA 27428): dorsal and lateral views, medial ridge of pleonites 1–3. Scales = 10 mm.

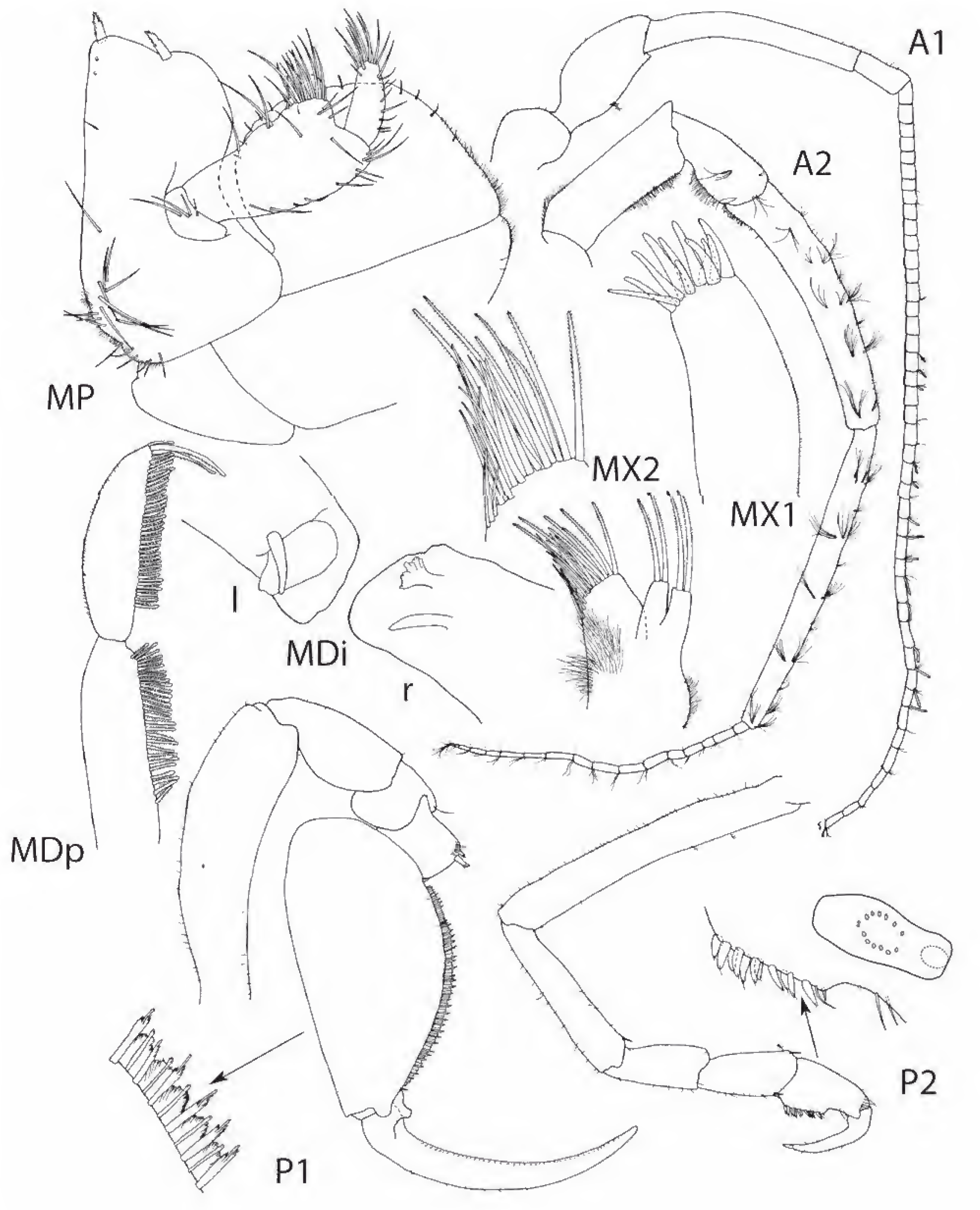

Figure 7. *Brucerolis howensis* sp. nov. Holotype male (NIWA 27431): antennae 1, 2, mandibular incisors, palp, maxilliped, pereopods 1, 2.

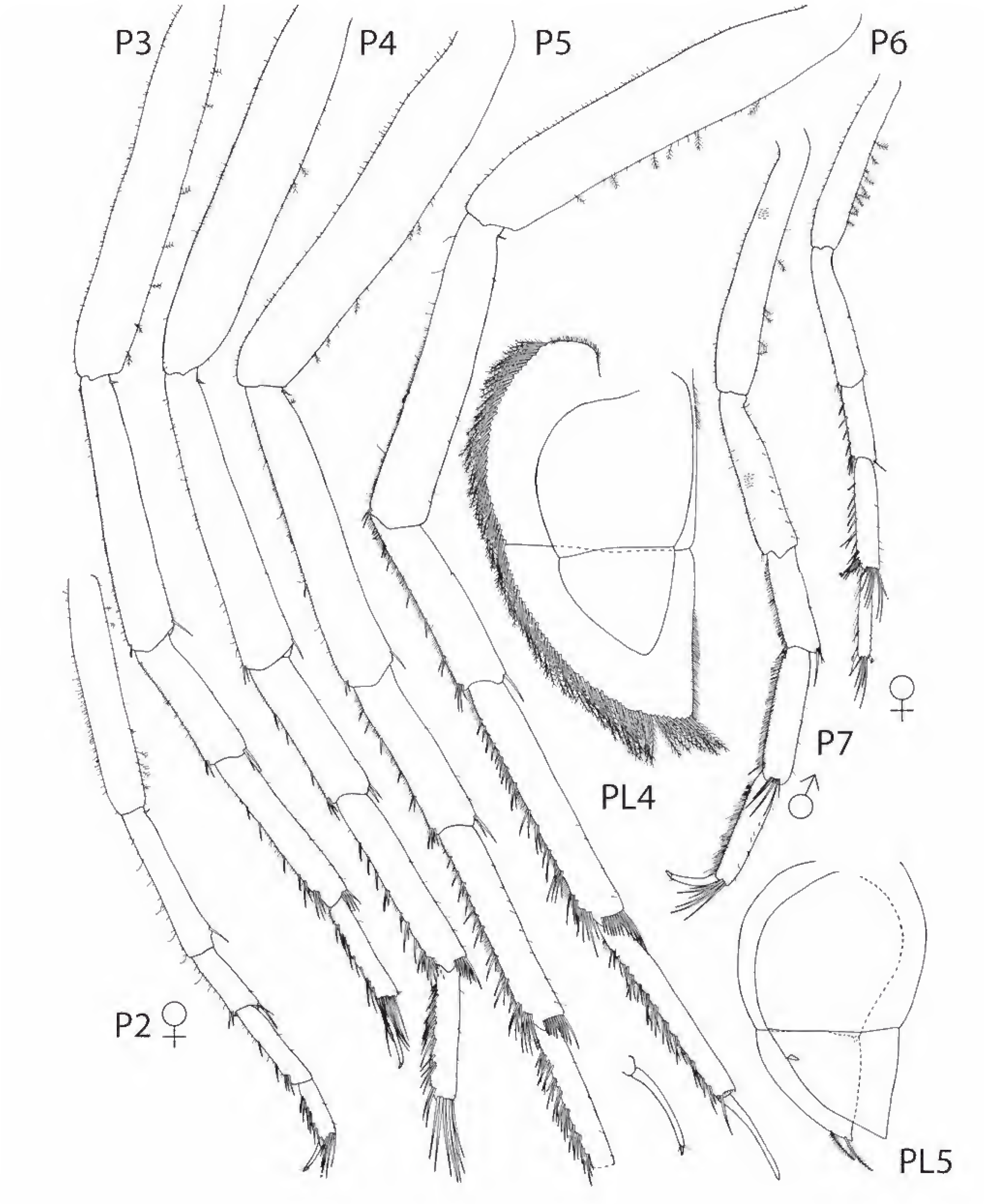

Figure 8. *Brucerolis howensis* sp. nov. Holotype male (NIWA 27431): pereopods 3–7, pleopods 4, 5. Paratype female (NIWA 27428): pereopods 2, 7.

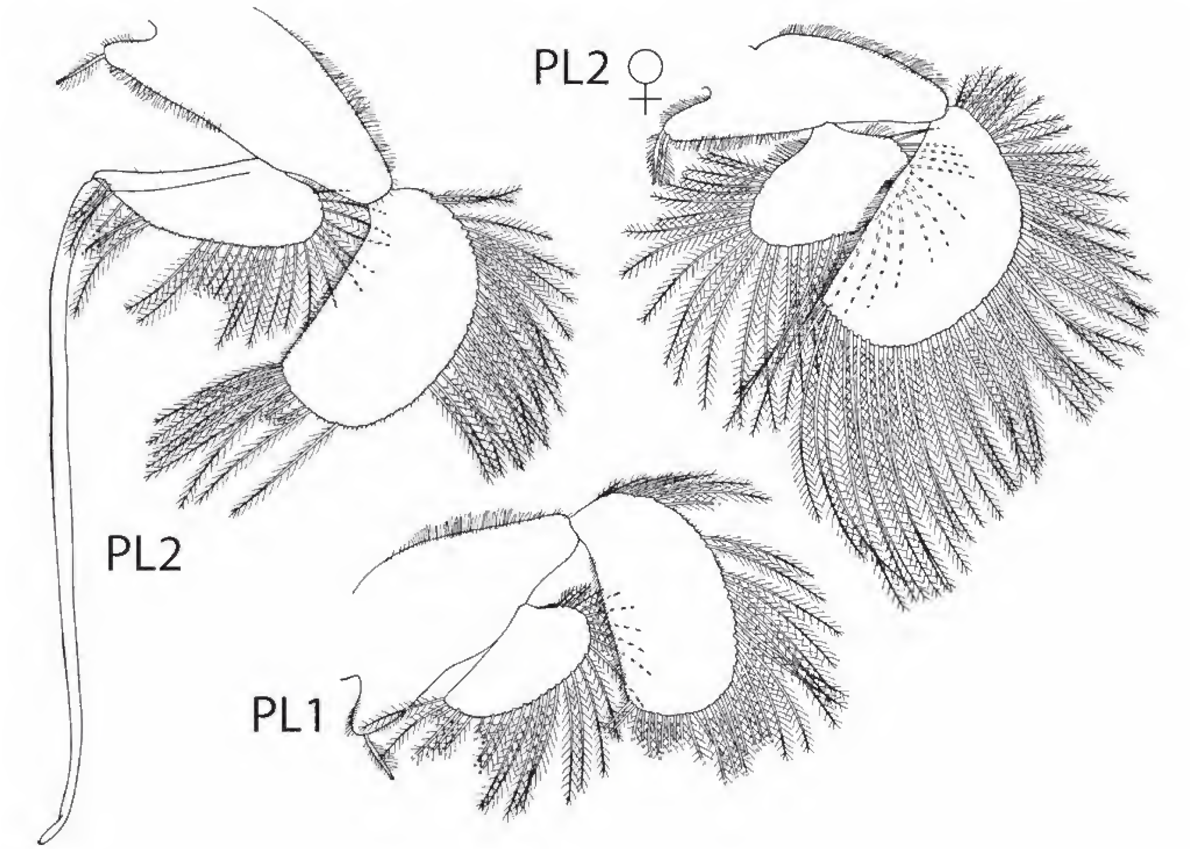

Figure 8. *Brucerolis howensis* sp. nov. Holotype male (NIWA 27431): pereopods 3–7, pleopods 4, 5. Paratype female (NIWA 27428): pereopods 2, 7.

epimeron 3 as long as pleotelson; pleonal epimera 2 and 3 with emarginate apices. Ventral coxal plates 2–4 with transverse ridges on mesial, anterior and posterior margins outlining a transverse depression. Antenna 1 peduncle articles 3+4 2 times as long as article 2 (anterior margin); flagellum of about 43 articles. Antenna 2 peduncle article 5 1.2 times as long as article 4; flagellum of 16 articles. Pereopod 1 propodus 2 times as long as greatest width. Pereopod 2 palm dorsal length 1.5 times greatest width, with short heel, straight setose proximal palm, convex distal palm, with 14 robust setae arranged in oval. Pereopod 7 carpus 3 times as long as greatest width; propodus 4.2 times as long as greatest width, propodus tapering from near base, lower margin straight; dactylus curved, 0.5 times as long as propodus. Pleopod 2 endopod with evenly tapering distal angle bearing appendix masculina; appendix masculina 3.8 times as long as straight margin of endopod. Uropodal exopod 0.85 length of endopod.

Female. Pereonite 1, lateral margin of female convex anteriorly, with distinct step-like interruption and straight posteriorly. Coxal dorsal plate 2 of female 0.5 times as long as half pereonal tergite 2 width; plate 4 of female 0.8 times as long as half pereonal tergite 4 width (following plates increasing in length); plate 6 of female extending beyond tip of pleotelson by 1.8 times middorsal length of pleotelson, the pair diverging over entire length, almost straight except at apex.

Size. Male length: 28–30 mm; female length: 27–30 mm.

Distribution. Tasman Sea, mid-Lord Howe Rise and Lord Howe Plateau, 31°'S–37°'S, 159°E–170°E, 1573–2096 m.

Etymology. This species is named for its distribution on the Lord Howe Rise.

Remarks. *Brucerolis howensis* is most similar to *B. nowra* (Fig. 1f), *B. victoriensis* and *B. cidaris*, all four with emarginate epimera apices. *Brucerolis howensis* can be distinguished by the combination of the weak projection of the anterolateral

lobes of the head, the concave anterior margin and lack of submarginal sculpture on the dorsal surface of pereonite 1 and male epimeron 3 barely reaching (female epimeron 3 not reaching) the posterior margin of the telson.

Brucerolis hurleyi sp. nov.

Figures 1e, 10–13

Material examined. Holotype: New Zealand, Chatham Rise, 43°29.69'S, 178°59.55'W, 499 m, 08 Sep 1989. (NIWA stn V366 TAM), NIWA 27424 (adult male, 23 mm).

Paratypes: collected with holotype, NIWA 27423 (adult female, 23 mm), NIWA 27425 (12 males, 17 females, 15 juveniles). New Zealand, Chatham Rise, 43°30'S, 179°15'E, 410 m, 24 Jan 1968 (NIWA stn G273), NIWA 27419 (6 males, 5 females, 1 juvenile); 43°31'S, 179°07'E, 413 m, 24 Jan 1968 (NIWA stn G283A), NIWA 27424 (5 males, 4 females, 3 juveniles); 43°58.5'S, 178°40'W, 460 m, 30 Mar 1969 (NIWA stn D904 TAS), NIWA 27420 (5 males, 4 females, 1 juvenile); 44°13.5'S, 177°04.7'W, 403 m, 23 Mar 1978 (NIWA stn Q33), NIWA 27418 (7 males, 6 females, 1 juvenile); 43°49.62–49.23'S, 176°59.82–59.57'E, 498–497 m, 16 Sep 1989 (NIWA stn V387 TAM), NMV J55314 (5 males, 16 females, 26 juveniles). Chatham Rise (Portobello Marine Laboratory Chatham Expedition stn 6), NIWA 27422 (2 males, 5 females, 3 juveniles). W of Chatham Is, 44°00'S, 178°06'E to 44°03'S, 178°09'E, 430 m, USS *Eltanin*, 29 Nov 1964, NMV J11625 (donation from USNM 123962) (1 male, 1 female).

Other material: numerous specimens from 82 NIWA stations.

Description of male holotype. Body length 29 mm. Body 0.9 times as long as greatest width (at coxae 3). Middorsal line without midposterior processes, not elevated in lateral view. Head, anterolateral margins concave, lateral corners acute and projecting anteriorly; width between anterolateral corners 1.2 times as wide as maximum span between lateral margins of eyes; head with paired strongly projecting curving acute processes on transverse ridge at bases of antennae 1, with prominent paired tubercles between eyes, with small, blunt median posterior tubercle, with obscure lobes lateral to median posterior tubercle. Pereonite 1 lateral margin convex anteriorly, straight over most of length, lateral margin upturned over anterior half, sharply crested, with sinuous rounded oblique ridge more or less parallel to margin, separated from it by a deep trough occupying about one-third of width, dorsal surface with obsolete oblique-transverse ridge reaching sinuous ridge. Coxal dorsal plate 2 1.1 times as long as half pereonal tergite 2 width (following plates increasing in length); plate 4 1.8 times as long as half pereonal tergite 4 width; plate 6 extending beyond tip of pleotelson by 2.6 times middorsal length of pleotelson, the pair diverging over entire length, almost straight except at apex; pleonal epimeron 2 1.8 times length of pleotelson; pleonal epimeron 3 1.1 times length of pleotelson; pleonal epimera 2 and 3 with acute apices. Ventral coxal plates 2–4 with a prominent tubercle at anteromesial corner, without marginal ridges. Antenna 1 peduncle articles 3+4 1.9 times as long as article 2 (anterior margin); flagellum of about 41 articles. Antenna 2 peduncle article 5 1.2 times as long as article 4; flagellum of 17 articles. Pereopod 1 propodus 2 times as long as greatest width. Pereopod 2 palm dorsal length 1.3 times greatest width, with short heel, straight setose proximal palm, convex distal palm, with 16 robust setae in U-shaped row. Pereopod 7 carpus 3.1 times as long as greatest width; propodus 4 times as long as greatest width, propodus elongate oval, widest at midpoint; dactylus curved, 0.4 times as long as propodus. Pleopod 2 endopod with evenly tapering distal angle bearing appendix masculina; appendix masculina 4.8 times as long as straight margin of endopod. Uropodal exopod 0.8 length of endopod.

Female. Pereonite 1, lateral margin of female as in male. Coxal dorsal plate 2 of female 0.6 times as long as half pereonal tergite 2 width; plate 4 of female 1.1 times as long as half pereonal tergite 4 width (following plates increasing in length); plate 6 of female extending beyond tip of pleotelson by 2 times middorsal length of pleotelson, the pair diverging over entire length, almost straight except at apex.

Size. Adult male and female body length 17–30 mm.

Distribution. New Zealand, western Cook Strait to eastern slope of New Zealand, Chatham Rise, Bounty Plateau, Campbell Plateau, 40°'S–53°S, 168°E–176°W, 315–1024 m.

Etymology. *Brucerolis hurleyi* is named for Dr Desmond E. Hurley, who first noted morphological variation within what he called *Serolis bromleyana* around New Zealand.

Remarks. *Brucerolis hurleyi* and *B. osheai* are similar, both with acute epimera apices, similarly shaped anterior head margin (although in *B. hurleyi*, the anterolateral corners of head are not continuous with anterior margin of pereonite 1), setose lower margins of the ischium, merus and carpus of male pereopod 2 and setulose carpus and propodus of male pereopod 7. *Brucerolis hurleyi* can be recognised by: strongly convex propodus palm of male pereopod 2; ventral coxal plates with an anteriorly projecting, circular tubercle on the anterior margin adjacent to the midline suture; lack of setules on the merus of the male pereopod 7; and absence of the colour pattern seen in most individuals of *B. osheai*. The species is unusual in the possession on antenna 1 flagellum articles of a row of denticles.

One unusual adult male specimen (NIWA stn D9 DR, SE Macquarie Island) has an appendix masculina on pleopods 2 and 3 on both sides.

Brucerolis macdonnellae (Menzies, 1962)

Serolis (*Serolis*) *macdonnellae* Menzies, 1962: 188–189, fig. 66.
Acutiserolis macdonnellae. — Brandt, 1988: 18, 21. — Brandt, 1991: 131.— Poore and Brandt, 1997: 159.
Serolis (*Acutiserolis*) *macdonnellae*. — Wägele, 1994: 53.
Brucerolis macdonnellae. — Poore and Storey, 2009: 152-153.

Distribution. South Atlantic, western side of South Sandwich island arc between Visokoi and Lesokov Island, 56°43'S, 27°41'W, 2741 m (only type known).

Remarks. Pereonite 1 of *Brucerolis macdonnellae* and *B. bromleyana* has an acute projection on the anterolateral margin and prominent submarginal and transverse ridges on the dorsal surface. In as far as the description of the damaged material allows, *Brucerolis macdonnellae* can be differentiated by the acute tips of epimera 2 and 3, shorter epimeron 3 and shorter, more curved coxal dorsal plates.

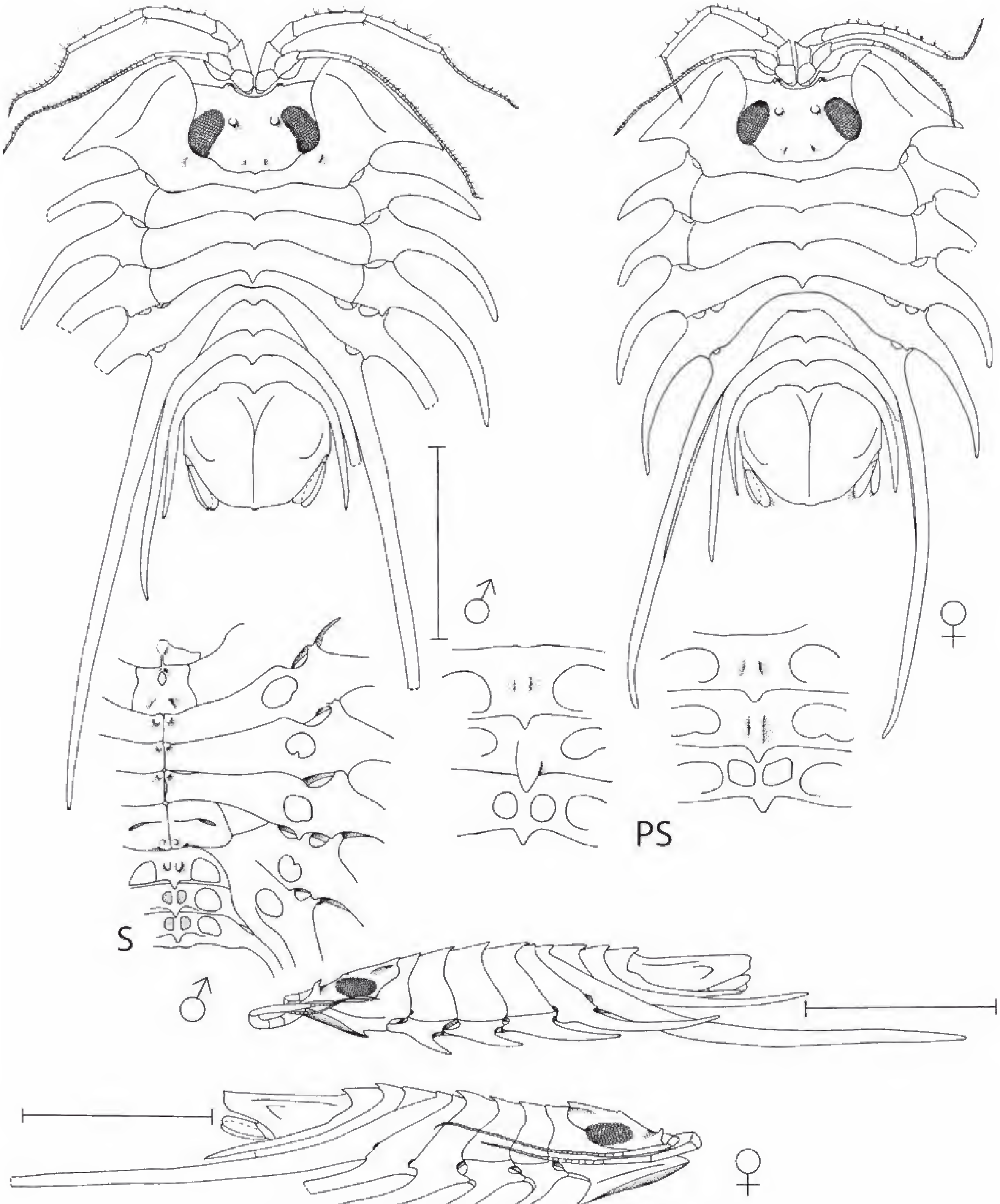

Figure 10. *Brucerolis hurleyi* sp. nov. Holotype male (NIWA 27424): dorsal and lateral views, sternites of pereonites 1–7, pleonites 1–3, medial ridge of pleonites 1–3. Paratype female (NIWA 27423): dorsal and lateral views, medial ridge of pleonites 1–3. Scale = 10 mm.

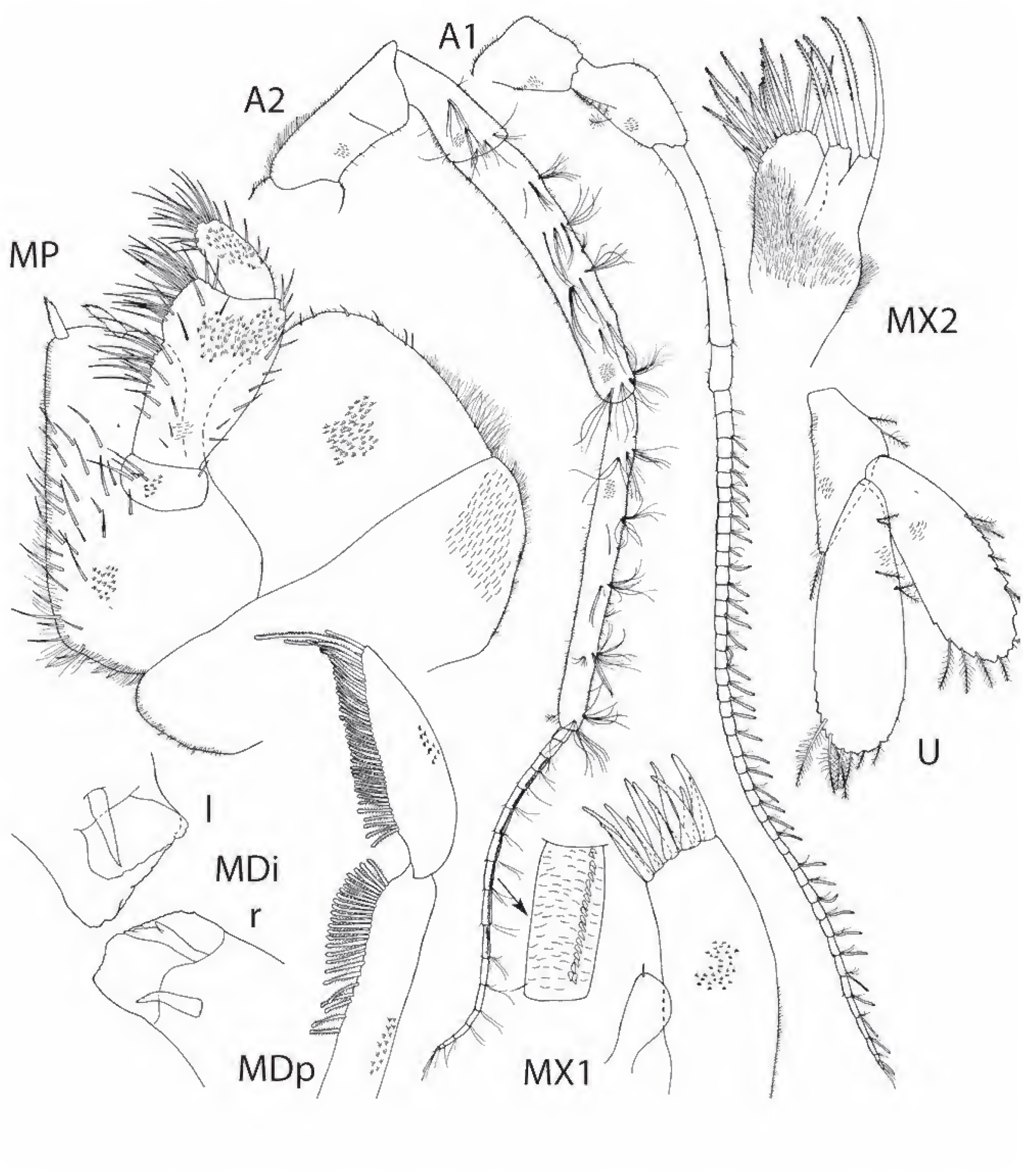

Figure 11. *Brucerolis hurleyi* sp. nov. Holotype male (NIWA 27424): antennae 1, 2 (with detail of antenna 2 flagellar article), mandibular incisors, palp, maxilla 2, maxilliped. Paratype female (NIWA 27423): dorsal view, uropod. Scale = 10 mm.

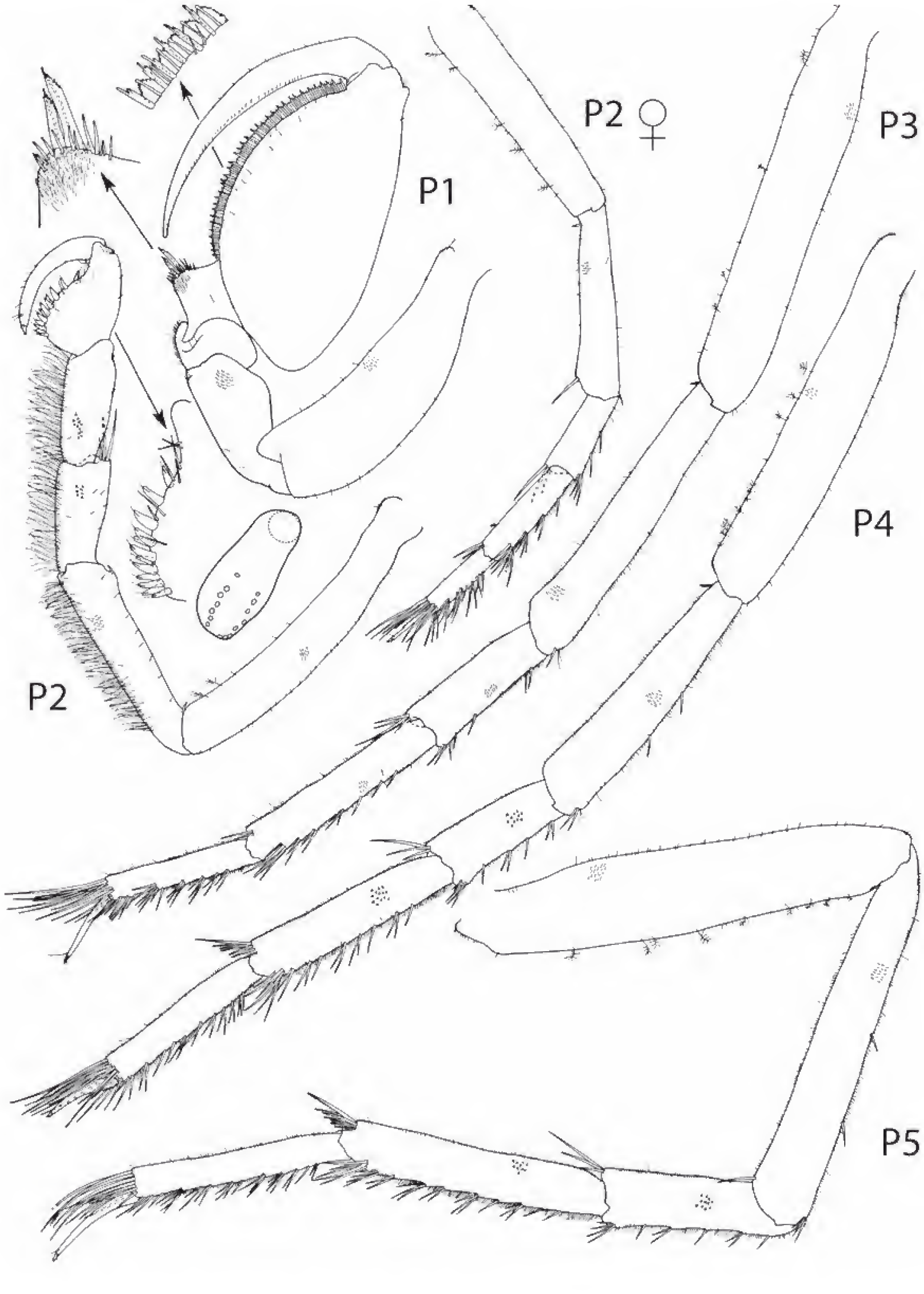

Figure 12. *Brucerolis hurleyi* sp. nov. Holotype male (NIWA 27424): pereopods 1–5. Paratype female (NIWA 27423): pereopod 2.

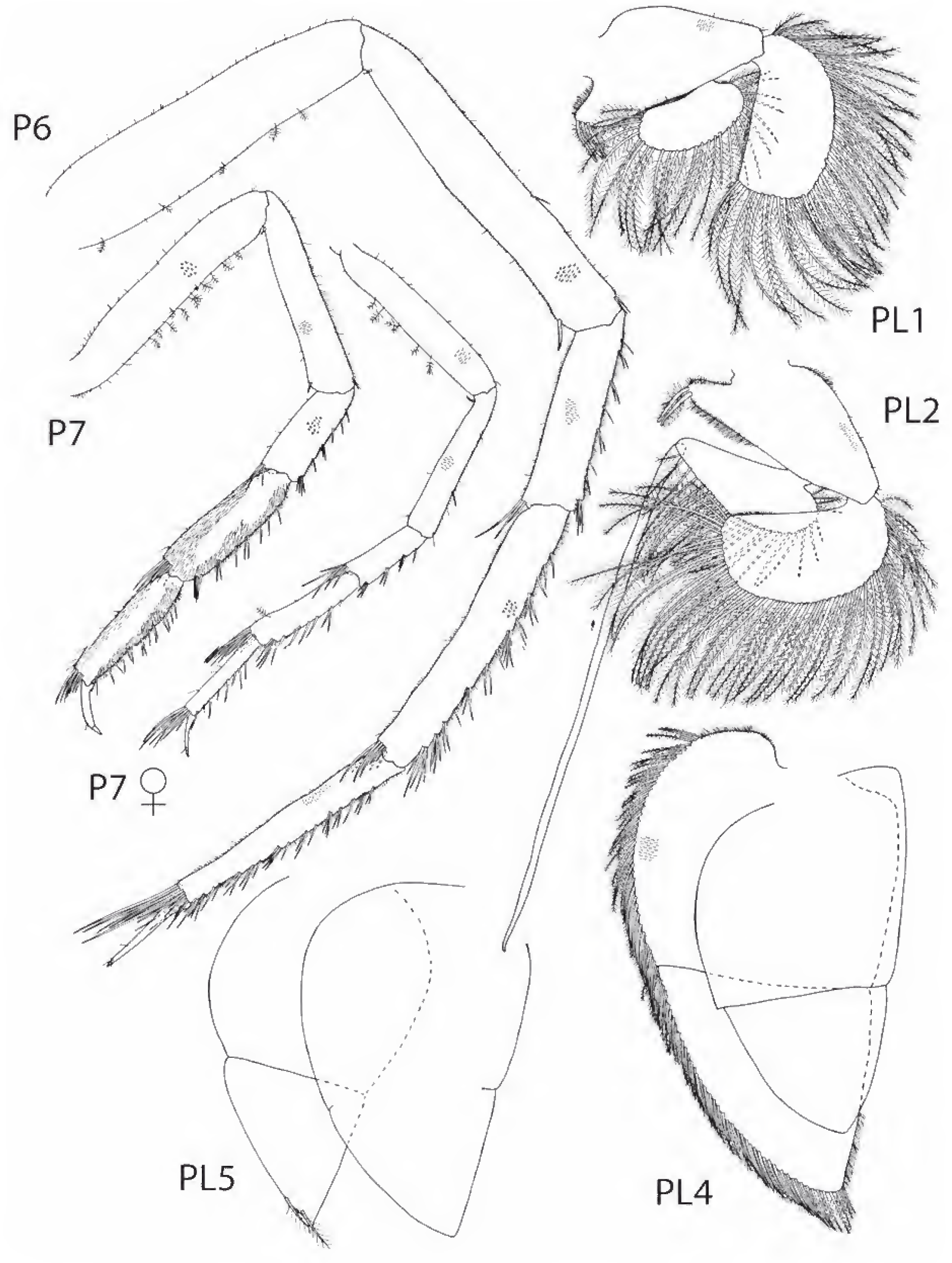

Figure 13. *Brucerolis hurleyi* sp. nov. Holotype male (NIWA 27424): pereopods 6, 7, pleopods 1, 2, 4, 5. Paratype female (NIWA 27423): pereopod 7.

Brucerolis maryannae (Menzies, 1962)

Serolis (*Serolis*) *maryannae* Menzies, 1962: 189, fig. 68.
Acutiserolis maryannae.—Brandt, 1988: 18, 21. — Brandt, 1991: 131. — Poore and Brandt, 1997: 159.
Serolis (*Acutiserolis*) *maryannae*. — Wägele, 1994: 53.
?*Brucerolis maryannae*. — Poore and Storey, 2009: 152-153.

Distribution. South Atlantic, continental rise S of Staten I., northwest Scotia Sea, 55°31.2'S, 64°07.5'W, 3839 m (only type known).

Remarks. *Brucerolis maryannae* is the only species in the genus to have a serrulate anterior margin of the head and pereonite 1. It shares with *B. bromleyana* the acute projection on the anterolateral margin of pereonite 1 and emarginate tips of epimera 2 and 3. These features and the long coxal plates and epimera suggest a relationship to this species. Menzies's (1962) illustration would indicate that the coxal keys and intervening apertures are absent. It may be possible that the keys are not visible in dorsal view on such a small female (18.8 mm) or that the drawing is incorrect.

Brucerolis osheai sp. nov.

Figures 1g, 14–17

Material examined. Holotype: New Zealand, Challenger Plateau, 49°30.5'S, 167°40'E, 594 m, 16 Jan 1965 (NIWA stn F90), NIWA 27442 (adult male, 21 mm).

Paratypes: collected with holotype, NIWA 27441 (adult female, 21 mm), NIWA 27440 (adult female, 22 mm), NMV J55316 (1 male, 1 female, 1 juvenile), NIWA 27438 (2 males, 1 juvenile). New Zealand, Challenger Plateau, 48°45'S, 172°00'E, 649 m, 21 Jan 1965 (NIWA stn F107), NIWA 27437 (9 males, 7 females, 3 juveniles); 52°21'S, 173°09'E, 603 m, 01 Jan 1965 (NIWA stn F1470), NIWA 27432 (3 males, 4 females, 1 juvenile); 51°20'S, 172°42'E, 539 m, 30 Jan 1965 (NIWA stn F136 TAM), NIWA 27436 (2 males); 50°31.5'S, 168°00'E, 433 m, 15 Jan 1965 (NIWA stn F88 TAM), NIWA 27433 (2 males, 2 juveniles); 48°32'S, 168°54.5'E, 695 m, 18 Jan 1965 (NIWA stn F99 TAM), NIWA 27439 (7 males, 2 females, 2 juveniles).

Description of male holotype. Body length 21 mm. Body 0.85 times as long as greatest width (at coxae 3). Middorsal line without midposterior processes, not elevated in lateral view. Head, anterolateral margins convex and continuous with anterior margin of pereonite 1; width between anterolateral corners 1.2 times as wide as maximum span between lateral margins of eyes; head with paired strongly projecting curving acute processes on transverse ridge at bases of antennae 1, with prominent paired tubercles between eyes, with small, blunt median posterior tubercle, with obscure lobes lateral to median posterior tubercle. Pereonite 1 lateral margin convex anteriorly, straight over most of length, lateral margin upturned over anterior half, sharply crested, with sinuous broadly rounded oblique ridge more or less parallel to margin, separated from it by a shallow concave trough occupying about one-third of width, dorsal surface with obsolete oblique-transverse ridge. Coxal dorsal plate 2 as long as half pereonal tergite 2 width (following plates increasing in length); plate 4 1.8 times as long as half pereonal tergite 4 width; plate 6 extending beyond tip of pleotelson by 2.2 times middorsal length of pleotelson, the pair parallel, straight distally; pleonal epimeron 2 1.7 times length of pleotelson; pleonal epimeron 3 as long as pleotelson; pleonal epimera 2 and 3 with acute apices. Ventral coxal plates 2–4 with transverse ridges on mesial, anterior and posterior margins outlining a transverse depression. Antenna 1 peduncle articles 3+4 2 times as long as article 2 (anterior margin); flagellum of about 50 articles. Antenna 2 peduncle article 5 1.1 times as long as article 4; flagellum of 16 articles. Pereopod 1 propodus 1.9 times as long as greatest width. Pereopod 2 palm dorsal length 1.7 times greatest width, with short right-angled heel, convex palm, with 13 robust setae in U-shaped row. Pereopod 7 carpus 3 times as long as greatest width; propodus 3.5 times as long as greatest width, propodus elongate oval, widest at midpoint; dactylus curved, 0.4 times as long as propodus. Pleopod 2 endopod with evenly tapering distal angle bearing appendix masculina; appendix masculina 6 times as long as straight margin of endopod. Uropodal exopod 0.9 length of endopod.

Female. Pereonite 1, lateral margin of female as in male. Coxal dorsal plate 2 of female 0.6 times as long as half pereonal tergite 2 width; plate 4 of female as long as half pereonal tergite 4 width (following plates increasing in length); plate 6 of female extending beyond tip of pleotelson by 1.9 times middorsal length of pleotelson, the pair diverging over entire length, almost straight except at apex.

Size. Male length: 21–22 mm; female length: 19–22 mm.

Distribution. New Zealand, Campbell Plateau, 48°S–52°S, 168°E–174°E, 347–735 m.

Etymology. For Steve O'Shea, who arranged for the loan of the material from New Zealand on which much of this work is based.

Remarks. *Brucerolis osheai* is similar to *B. hurleyi* but may be distinguished by a more pronounced median posterior tubercle on the head, the anterolateral corners of head continuous with anterior margin of pereonite 1, a generally smaller body with characteristic pigment spots on the antennae, head and pereonites, a setulate lower margin of the male pereopod 7 merus, carpus and propodus and ridged ventral coxae.

Brucerolis victoriensis sp. nov.

Figures 1h, 18–21

Material examined. Holotype: Australia, Victoria, 85 km S of Point Hicks, 38°31.41'S, 149°21.10'E to 38°30.58'S, 149°21.50'E, 1360–1986 m, 26 Oct 1988, G.C.B. Poore et al., RV *Franklin* (stn SLOPE 72), NMV J55376 (adult male, 34 mm).

Paratypes: Australia, Tasmania, 27 nautical miles W of Sandy Cape, 41°25.39'S, 144°12.66'E to 41°23.40'S, 149°09.01'E, 1165–1180 m, 11 Mar 1989, FRV *Soela*, SAM C6809 (adult female, 31 mm); Victoria, S of Point Hicks, 38°25.90'S, 148°58.60'E, 1850 m, 26 Jul 1986 (stn SLOPE 25), NMV J19212 (1 male, 1 female, 1 juvenile); NSW, 67 km ENE of Nowra, 34°41.97'S, 151°22.44'E, 1642–1896 m, 22 Oct 1988 (stn SLOPE 59), NMV J19208 (1 male, 1 female, 4 juveniles); Victoria, 67 km S of Point Hicks, 38°23.95'S, 149°17.02'E, 1119–1277 m, 25 Oct 1988 (stn SLOPE 67), NMV J19207 (1 male, 28 mm); Victoria, 85 km S of Point Hicks, 38°31.41'S, 149°21.10'E to 38°30.58'S, 149°21.50'E, 1360–1986 m, 26 Oct 1988 (stn SLOPE 72), NMV J19203 (2 adult males, 30 mm), NIWA 49602 (1 male); Victoria,

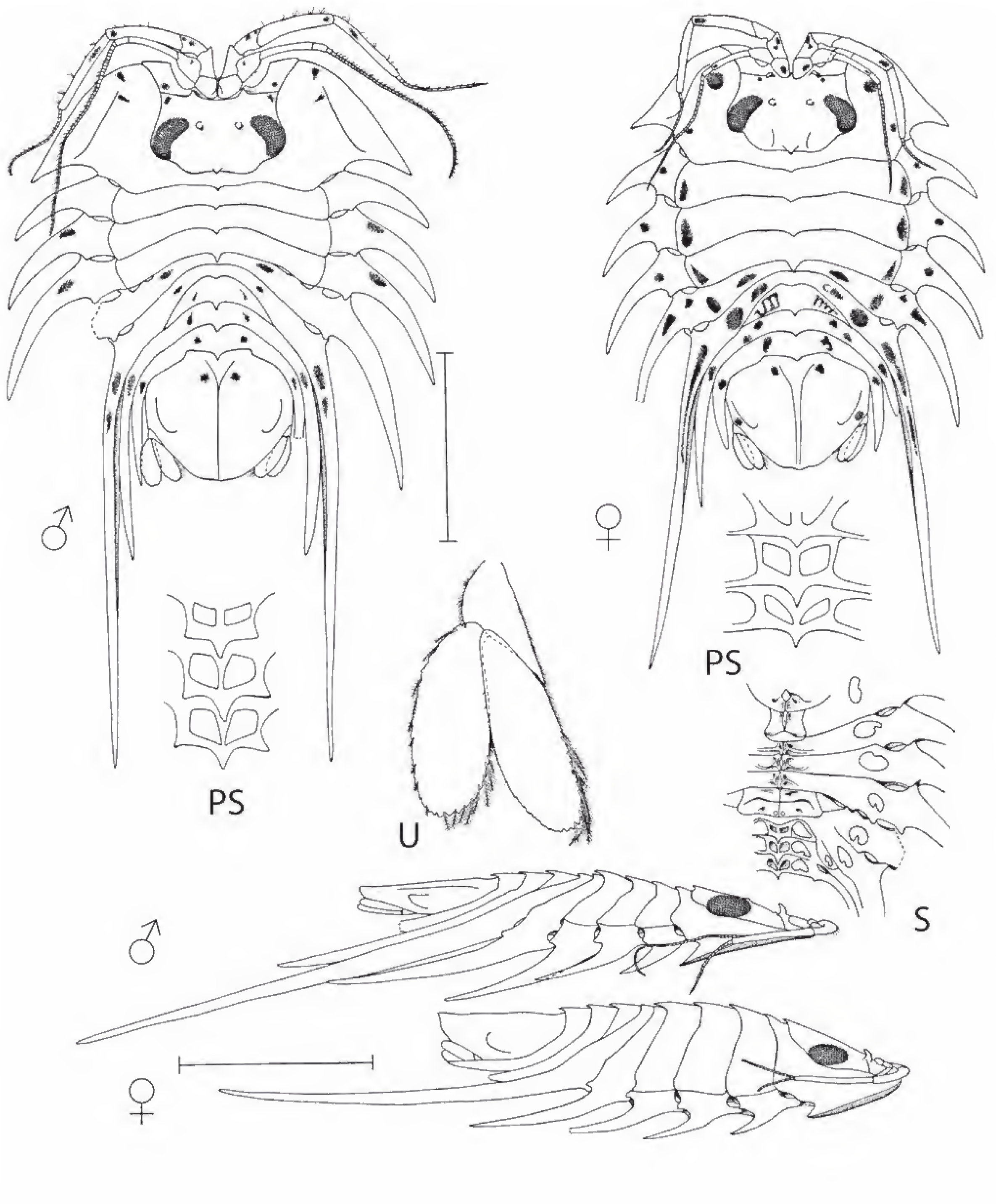

Figure 14. *Brucerolis osheai* sp. nov. Holotype male (NIWA 27442): dorsal and lateral views, sternites of pereonites 1–7, pleonites 1–3, medial ridge of pleonites 1–3, uropod. Paratype female (NIWA 27441): dorsal and lateral views, medial ridge of pleonites 1–3. Scale = 10 mm.

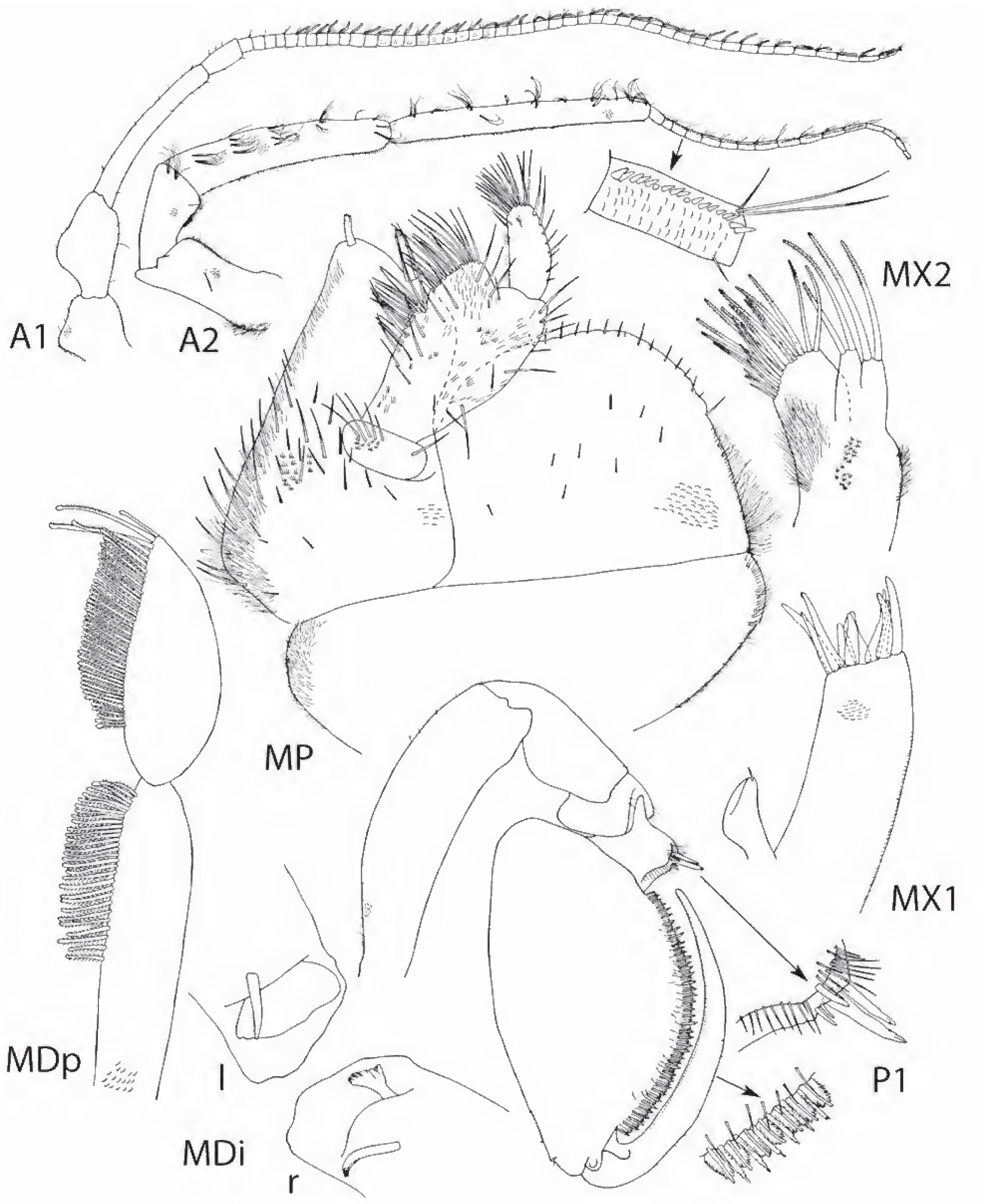

Figure 15. *Brucerolis osheai* sp. nov. Holotype male (NIWA 27442): antennae 1, 2 (with detail of antenna 2 flagellar article), mandibular incisors, palp, maxillae 1, 2, maxilliped, pereopod 1.

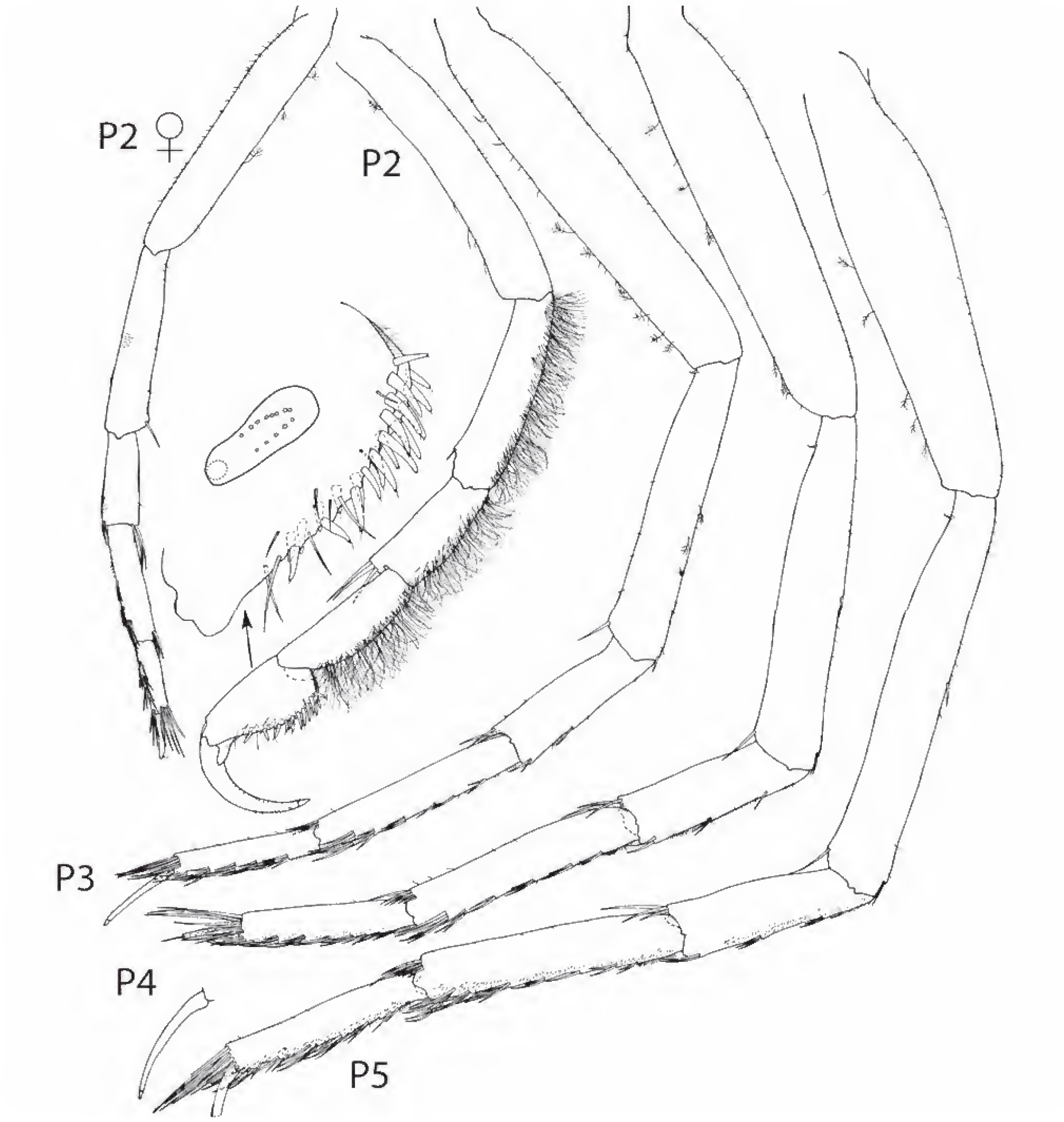

Figure 16. *Brucerolis osheai* sp. nov. Holotype male (NIWA 27442): pereopods 2–5. Paratype female (NIWA 27441): pereopod 2.

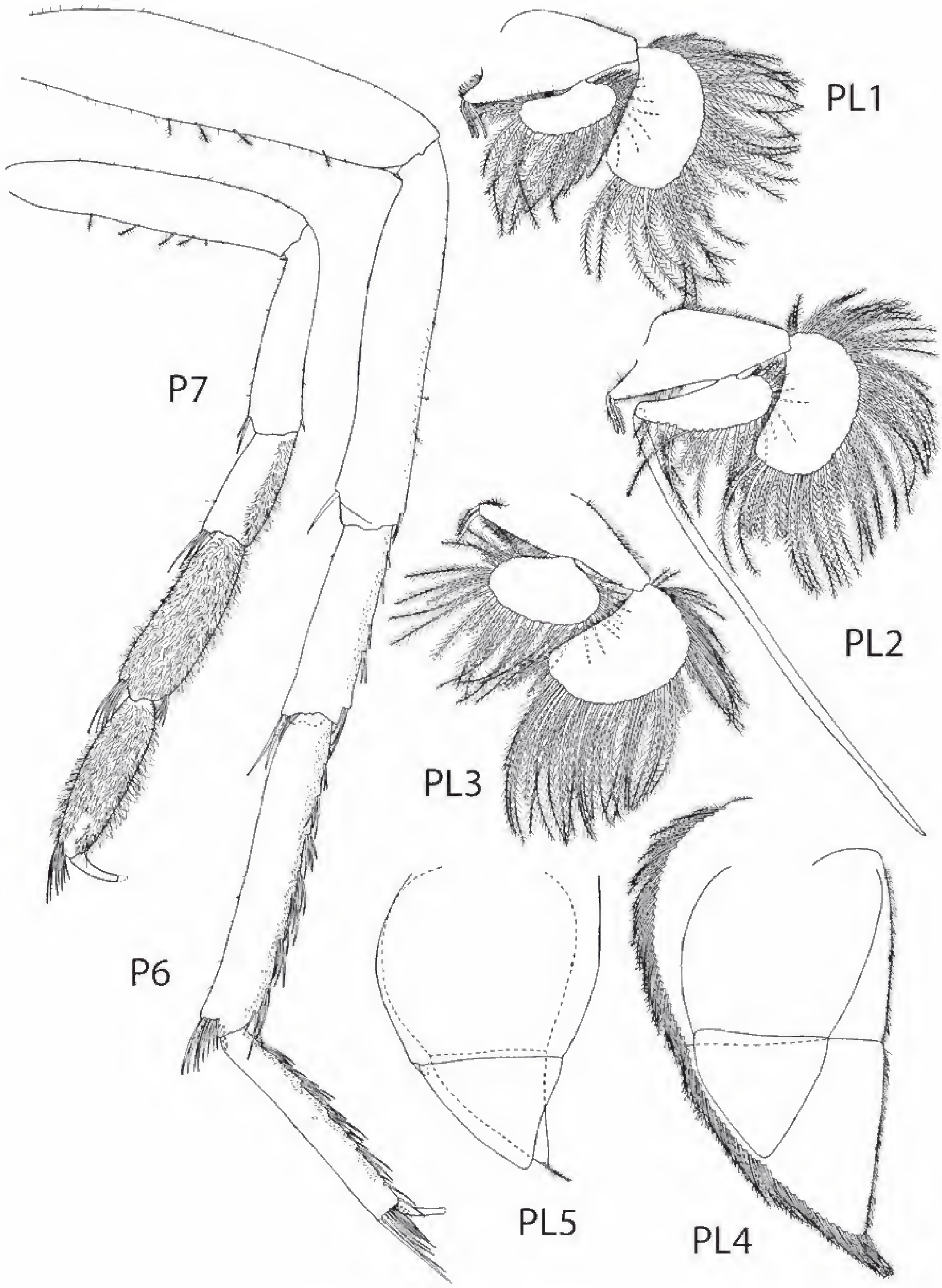

Figure 17. *Brucerolis osheai* sp. nov. Holotype male (NIWA 27442): pereopods 6, 7, pleopods 1–5.

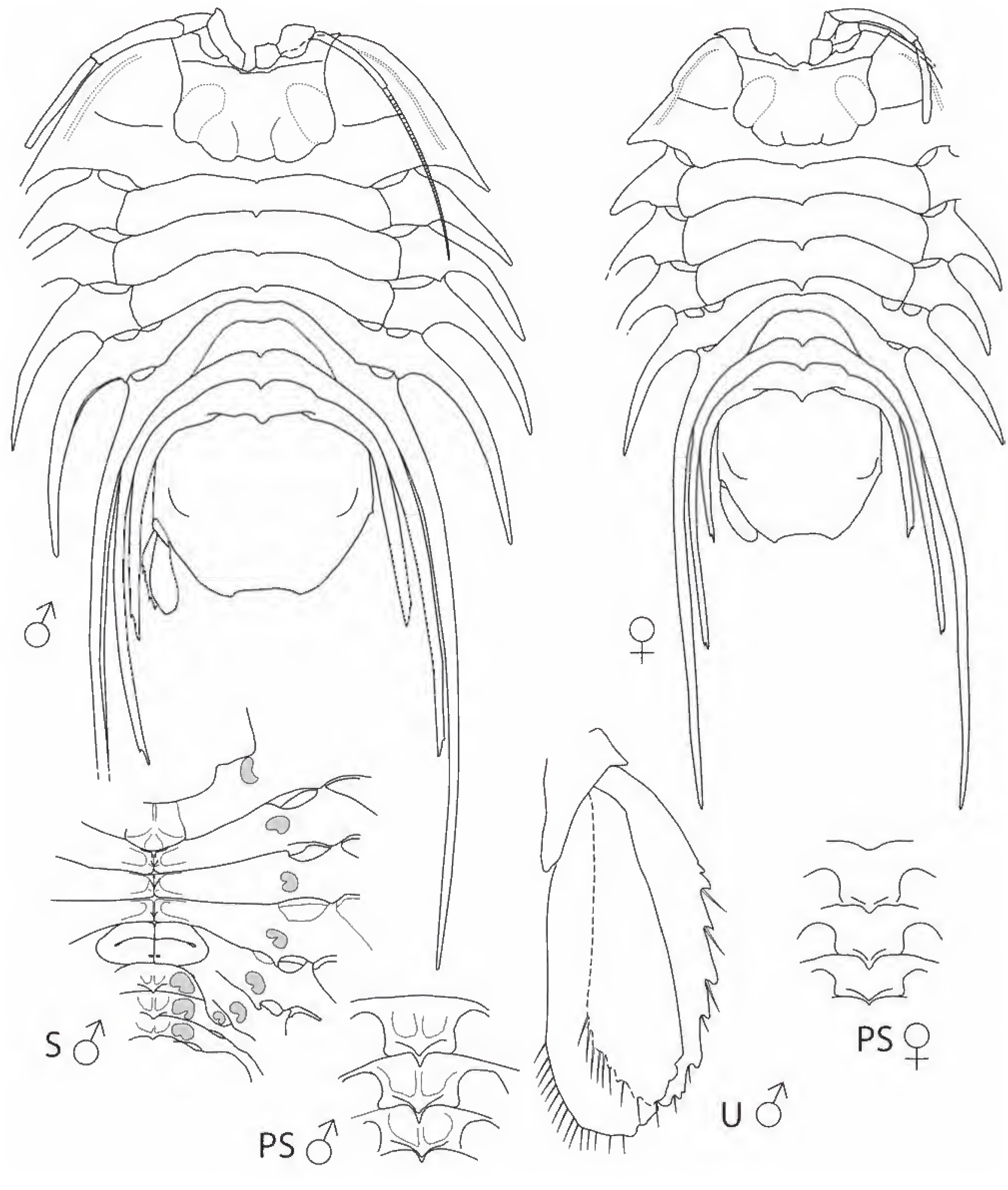

Figure 18. *Brucerolis victoriensis* sp. nov. Holotype male (NMV J55376): dorsal view, sternites of pereonites 1–7, pleonites 1–3, medial ridge of pleonites 1–3, uropod. Paratype female (SAM): dorsal view, medial ridge of pleonites 1–3. Scale = 10 mm.

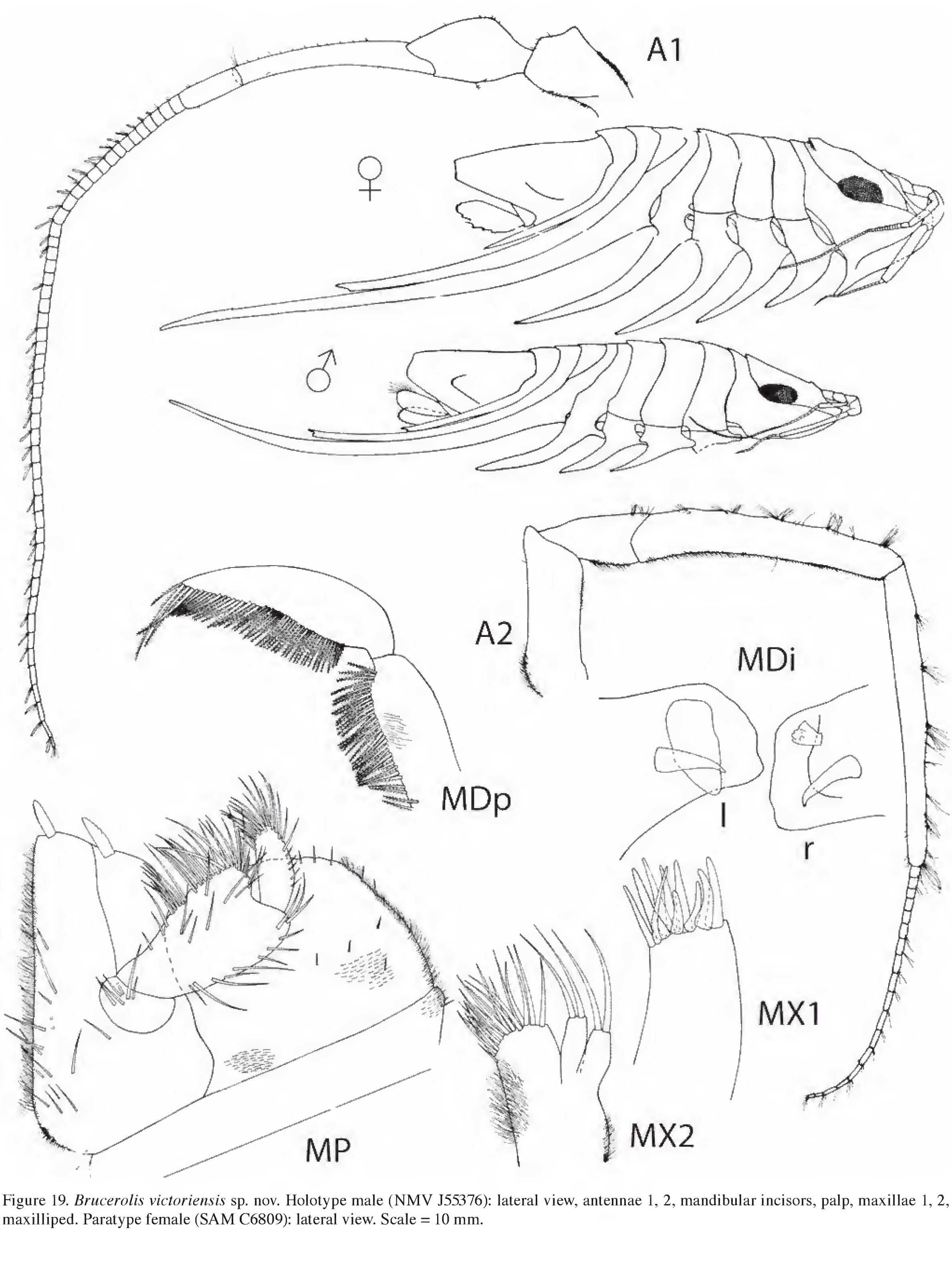

Figure 19. *Brucerolis victoriensis* sp. nov. Holotype male (NMV J55376): lateral view, antennae 1, 2, mandibular incisors, palp, maxillae 1, 2, maxilliped. Paratype female (SAM C6809): lateral view. Scale = 10 mm.

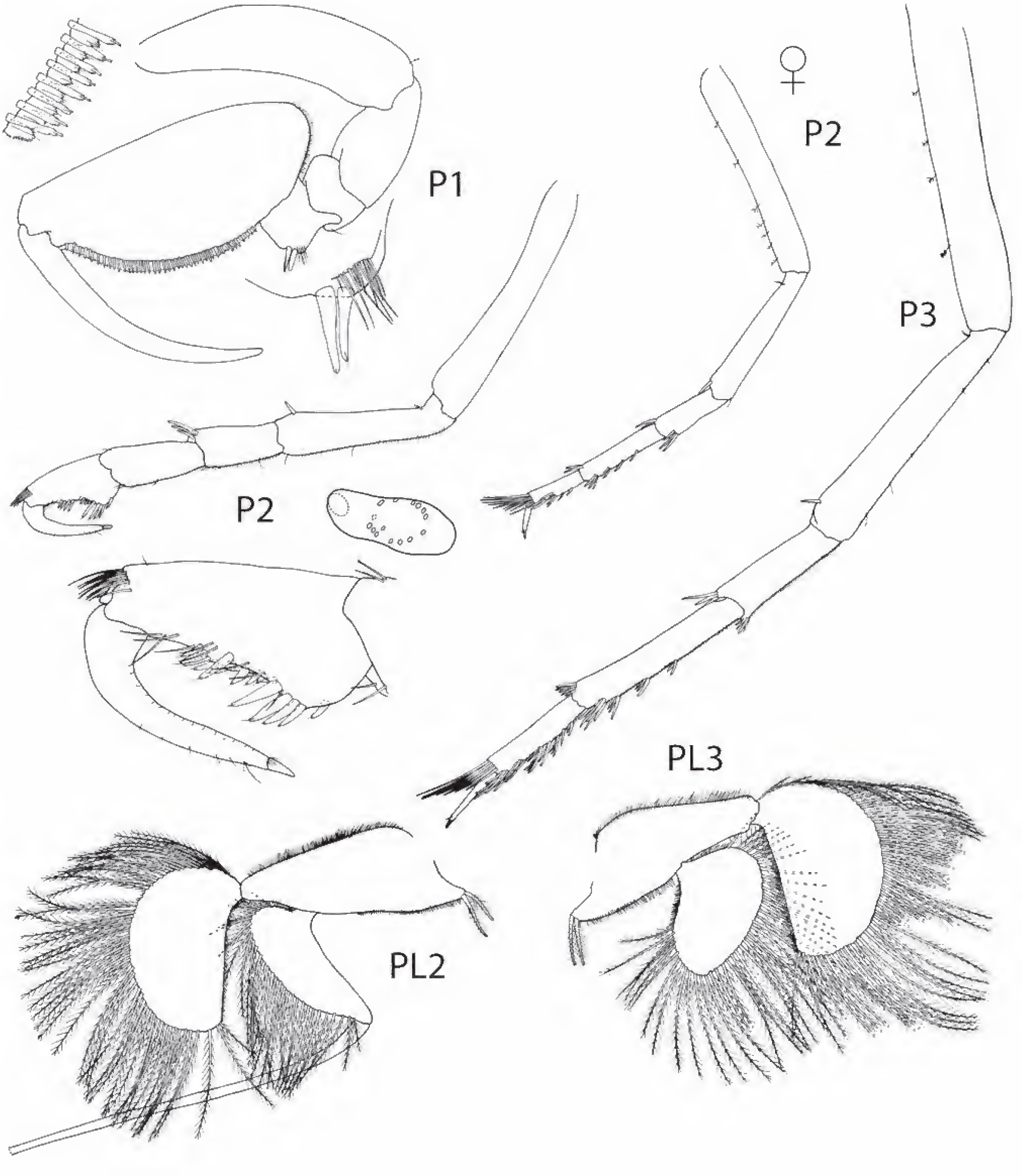

Figure 20. *Brucerolis victoriensis* sp. nov. Holotype male (NMV J55376): pereopods 1–3, pleopods 2, 3. Paratype female (SAM C6809): pereopod 2.

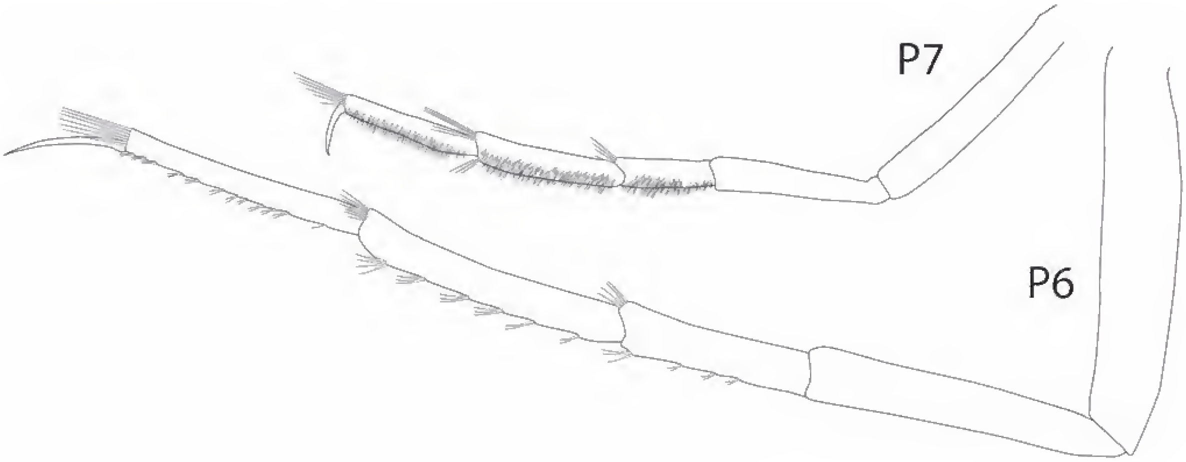

Figure 21. *Brucerolis victoriensis* sp. nov. Holotype male (NMV J55376): pereopods 6, 7.

63 km S of Point Hicks, 38°22.61'S, 149°20.20'E, 1073–1169 m, 25 Oct 1988 (stn SLOPE 68), NMV J19206 (3 males, 32 mm), NIWA 49603 (2 males); Victoria, 76 km S of Point Hicks, 38°29.33'S, 149°19.98'E, 1750–1840 m, 26 Oct 1988 (stn SLOPE 69), NMV J19204 (2 males, 32 mm, 20 juveniles, 6–24 mm); Victoria, S of Point Hicks, 38°30.33'S–38°30.88'S, 149°22.98'E–149°21.63'E, 19 Apr 2000 (stn SS01/00/172), NMV J19208 (5 males, 4 juveniles).

Other material: South Australia, Bonney Coast, Bonney Canyon, 37°52.48'S–37°53.39'S, 139°19.75'E–139° 20.60'E), 2010 m, 16 Feb 2008 (stn SS02/2008/PC3), SAM (5 males, 33–38 mm, 3 females, 34–36 mm, 13 juveniles, 19–30 mm).

Description of male holotype. Body length 34 mm ().Body as long as greatest width (at coxae 3). Middorsal line with small midposterior processes, barely elevated in lateral view. Head, anterolateral margins concave, lateral corners acute and projecting anteriorly (slightly); width between anterolateral corners as wide as maximum span between lateral margins of eyes; head without paired processes on transverse ridge at bases of antennae 1, with obsolete paired tubercles between eyes, with small, blunt median posterior tubercle, with obscure lobes lateral to median posterior tubercle. Pereonite 1 lateral margin anteriorly convex, straight over most of length, lateral margin upturned over anterior half, sharply crested, with sinuous high rounded oblique ridge more or less parallel to margin, separated from it by a shallow trough occupying about one-quarter of width, dorsal surface with obsolete oblique-transverse ridge reaching sinuous ridge. Coxal dorsal plate 2 slightly more than half as long as pereonal tergite 2 width (following plates increasing in length); plate 4 1.5 times as long as half pereonal tergite 4 width; plate 6 extending beyond tip of pleotelson by 2.1 times middorsal length of pleotelson, the pair diverging and then converging slightly apically, curving evenly; pleonal epimeron 2 1.9 times length of pleotelson; pleonal epimeron 3 1.1 times length of pleotelson; pleonal epimera 2 and 3 with acute apices. Ventral coxal plates 2–4 with transverse ridges on mesial, anterior and posterior margins outlining a transverse depression. Antenna 1 peduncle articles 3+4 1.9 times as long as article 2 (anterior margin); flagellum of about 50 articles. Antenna 2 peduncle article 5 similar length to article 4; flagellum of 18 articles. Pereopod 1 propodus 2.2 times as long as greatest width. Pereopod 2 palm dorsal length 1.9 times greatest width, with short right-angled heel, convex palm with 15 robust setae arranged in oval (several shorter than others). Pereopod 7 carpus 4.7 times as long as greatest width; propodus 5.6 times as long as greatest width, propodus tapering from near base, lower margin straight; dactylus curved, 0.4 times as long as propodus. Pleopod 2 endopod with convex distal margin, sharply tapering to base of appendix masculina. Uropodal exopod 1 length of endopod.

Female. Pereonite 1, lateral margin of female convex anteriorly, with distinct step-like interruption and straight posteriorly. Coxal dorsal plate 2 of female 0.6 times as long as half pereonal tergite 2 width; plate 4 of female as long as half pereonal tergite 4 width (following plates increasing in length); plate 6 of female extending beyond tip of pleotelson by 1.9 times middorsal length of pleotelson, the pair diverging and then converging slightly apically, curving evenly.

Size. Adult male and female body length: 28–38 mm.

Distribution. Australia, eastern and southern continental slope of NSW, Vic., Tas. and eastern SA, 34°42'S–41°25'S, 1073–2010 m.

Etymology. For Victoria, the Australian state where most specimens have been taken.

Remarks. The submarginal anterolateral groove on pereonite 1, defined by its upturned margin and sharp inner ridge identify *Brucerolis victoriensis.* The species shares with the non-New Zealand species (*B. howensis* and *B. cidaris*) emarginate epimera and absence of projections on the transverse ridge of the head.

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We thank Steven O'Shea and Kareen Schnabel of NIWA, Wellington, New Zealand, Keith Probert from the Portobello Marine Station, University of Otago, New Zealand, and Wolfgang Zeidler and Thierry Laperousaz, South Australian Museum, Adelaide, for the loan of material. We thank Joanne Taylor for handling, cataloguing and otherwise organising the bulky loans at Museum Victoria. We especially thank Niel Bruce, now at Museum of Tropical Queensland, Townsville, Australia, for critical comments on a first draft of this manuscript and alerting us to the "*Acutiserolis-Cuspidoserolis* problem".

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New records of the shrimp genus *Lissosabinea* (Caridea: Crangonidae) from Australia including descriptions of three new species and a key to world species.

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Abstract

Taylor, J. & Collins, D.J. 2009. New records of the shrimp genus *Lissosabinea* (Caridea: Crangonidae) from Australia including descriptions of three new species and a key to world species. *Memoirs of Museum Victoria* 66: 175–187.

Five species of *Lissosabinea* (Crustacea: Caridea: Crangonidae) are reported from Australia: three species are new to science, *L. arthuri* sp. nov. from 260–265 metres off Victoria, *L. beresfordi*. sp. nov. from 370–410 metres off Tasmania and *L. lynseyae* sp. nov. from 414–421 metres off Western Australia. Two species are new records for Australian waters, *L. ecarina* Komai, 2006 from 110 metres and *L. indica* (De Man, 1918) from 110–451 metres off the continental shelf of north-western Western Australia. These records expand the number of *Lissosabinea* species previously recorded world wide from five to eight. A revised key and illustrated guide to the world species is provided.

Keywords

Crustacea, Decapoda, Caridea, Crangonidae, *Lissosabinea*, new species, key, Western Australia, Victoria, Tasmania, Australia, taxonomy.

Introduction

The crangonid shrimp genus *Lissosabinea* Christoffersen, 1988 inhabit soft bottom sediments of upper bathyl zones at depths between 146–830 m. The five species described worldwide are rare, reported from limited geographic locations that are often confined to or near their type localities: *L. armata* Komai, 2006 from New Caledonia (Komai, 2006), *L. ecarina* Komai, 2006 from the Philippines and Indonesia (Komai, 2006), *L. indica* (De Man, 1918) from the western Pacific, Japan, Indonesia, Coral Sea and New Caledonia (De Man, 1918, De Man, 1920; Chace, 1984; Takeda & Hanamura, 1994; Kim & Natsukari, 2000; Komai, 2006), *L. tridentata* (Peqeugnat, 1970) from the Gulf of Mexico (Peqeugnat, 1970; Dardeau & Heard, 1983; Christoffersen, 1988; Spivak, 1997; Komai, 2006) and *L. unispinosa* Komai, 2006 from New Caledonia and Tonga (Komai, 2006).

Diagnostic characters of *Lissosabinea* include the pair of lateral teeth on the rostrum, lack of conspicuous lateral carinae on the carapace, a hump-backed abdomen and short, non-chelate second pereopod (Holthuis, 1993; Komai, 2006). Komai (2006) rediagnosed the genus *Lissosabinea* and discussed its close relationship to the genus *Sabinea* Ross, 1835. He disputed the hypothesis of Christoffersen (1998) that the genus had more affinity with *Paracrangon* Dana, 1852, *Vercoia* Baker, 1904 and *Prionocrangon* Wood-Mason & Alcock, 1891 and suggested that the original definition of the genus was derived from insufficient character analysis.

Poore, (2004) recorded *Lissosabinea tridentata* Pequegnat, 1970 from Victoria, Australia and reproduced Dardeau & Heard's (1983) figure of a specimen from the Gulf of Mexico. The specimen he referred to is here described as a new species.

Examination of a small crangonid collection held at Museum Victoria has uncovered 5 specimens belonging to three new species of this rare genus which are described herein. Three specimens of *L. arthuri* sp. nov. were collected from 260–265 metres off Victoria, one specimen of *L. beresfordi*. sp. nov. from 370–410 metres off Tasmania and one specimen of *L. lynseyae* sp. nov. from 414–421 metres off Western Australia. Further material collected recently from the north-western shelf of Western Australia were identified as *L. ecarina* Komai, 2006 from 110 metres and *L. indica* (De Man, 1918) from 110–451 metres and are new records for Australian waters. Due to the rarity of the genus Komai (2006) acknowledged that it was difficult to comment on the biogeography of the genus. He suggested that the highly abbreviated larval development (because of the large and few eggs) goes someway to explaining the limited geographical ranges of the species. These new discoveries expand the geographic range of the genus into the southern hemisphere and increase the number of known species from five to eight.

Abbreviations are: Tas, Tasmania; Vic, Victoria; WA, Western Australia which are all Australian states. NMV, Museum Victoria, Melbourne; WAM, Western Australian Museum, Perth, where material is lodged; cl. refers to the postorbital carapace length. Previously published and original illustrations were scanned and digitally 'inked' using Adobe Illustrator following Coleman's methods (Coleman, 2003).

Key to world species of *Lissosabinea* Christoffersen, 1988 (modified from Komai, 2006).

1. Carapace with only one tooth (epigastric tooth) on dorsal midline .... *L. unispinosa* [New Caledonia and Tonga, 410–610 m]
– Carapace with two or three teeth on dorsal midline 2
2. Carapace with three teeth on dorsal midline, but without posthepatic tooth 3
– Carapace with two teeth on dorsal midline and one or two posthepatic teeth 4
3. Carapace with small median teeth, epigastric tooth not reaching base of rostrum; median carina on third abdominal somite not extremely high; fourth and fifth pereopods slender .... *L. tridentata* [Gulf of Mexico, 391 m]
– Carapace with large median spines, epigastric tooth overreaching base of rostrum; median carina on third abdominal somite extremely high; fourth and fifth pereopods very stout .... *L. armata* [New Caledonia, 770–830 m]
4. Third abdominal somite weakly elevated medially, but without distinctly delineated median carina .... *L. ecarina* [WA, Philippines and Indonesia, 110–472 m]
– Third abdominal somite weakly or strongly elevated medially, but with distinct median carina 5
5. Dactylus of fourth pereopod long and slender, more than half length of propodus .... *L. lynseyae* sp. nov [WA, 441–421 m]
– Dactylus of fourth pereopod less than or equal to half length of propodus 6
6. Rostrum styliform in lateral view with relatively shallow ventral blade; third abdominal somite with posterodorsal margin somewhat produced posteriorly .... *L. indica* [WA, Japan, Indonesia, Coral Sea and New Caledonia, 146–700 m]
– Rostrum blunt in lateral view with medium to deep ventral blade; third abdominal somite with median posterodorsal margin strongly produced posteriorly 7
7. Carapace with second tooth on dorsal midline elevated relative to rostrum and epigastric tooth; first pereopod merus with ventral lamina terminating distally in prominent subacute tooth .... *L. arthuri* sp. nov [Vic, 260–265 m]
– Carapace with second tooth on dorsal midline equal in height to epigastric tooth and not elevated relative to rostrum; first pereopod merus with ventral lamina terminating distally in small blunt tooth .... *L. beresfordi* sp. nov [Tas, 370–410 m]

Systematics

Lissosabinea beresfordi sp. nov

Figures 1–2, 8.

Type material. Holotype. Australia, Southern Ocean, south of Tasmania, Huon 400 site (43°59.5' S, 147°32.76' E–43°59.7' S, 147°33.80' E), 370–410 m, 31 Mar 2007 (stn SS02-2007 06), NMV J57989 (male specimen, cl. 7.0 mm).

Etymology. Named for Museum Victoria Principal Curator, Gary Charles Beresford Poore, in gratitude of the opportunities and guidance he has provided the authors.

Type locality. Tasmania, Australia, 370–410 m.

Distribution. Known only from type location.

Description. Based on holotype male.

Rostrum slightly descending, directed forward, laterally compressed, falling just short of distal margin of first segment of antennular peduncle; distal part blunt, broadened with ventral blade; dorsal surface with low, blunt median ridge without setae; lateral tooth strong arising from 0.40 of rostrum; ventral margin straight, unarmed.

Carapace 1.30 times as long as wide. Middorsal carina sharp, extending nearly to posterodorsal margin of carapace, armed with two large teeth; epigastric tooth falling far short of base of rostrum arising at 0.22 of carapace length; second tooth equal in size to the first, arising from 0.57 of carapace length. Dorsal surface of carapace without setae. Antennal tooth small, not reaching anterior margin of cornea of eye. Branchiostegal tooth directed forward, falling short of anterior margin of antennal basicerite. Pterygostomian angle without tooth. Lateral face of carapace with relatively large hepatic and one post hepatic tooth, but epibranchial tooth absent; epibranchial carina conspicuous.

Sternal tooth on fifth thoracic somite well developed in male, extending beyond base of spur on fourth somite.

Second abdominal somite smooth on dorsal surface. Third somite with middorsal carina in posterior 0.52; posterodorsal margin of somite strongly produced posteriorly, partially covering fourth somite. Sixth somite about 1.80 times as long as high; dorsal surface flat on midline. Telson with two pairs of minute dorsolateral spines; posterolateral angle with one short blunt spine and two pairs of longer spines (broken); terminal process tapered, tip rounded.

Antennular peduncle reaching 0.50 of antennal scale; stylocerite reaching nearly distal margin of first segment, spiniform. Antennal scale about 0.67 of carapace length and 3.30 times as long as wide, lateral margin slightly curved, distal blade rounded; basicerite with ventrolateral spine reaching mid length of first segment of antennular peduncle.

Mouthparts not dissected.

First pereopod with palm about 4.35 times as long as wide; cutting edge of palm strongly oblique; pollex relatively large, triangular, slightly recurved; carpus armed with one moderately large spine on lateral margin; merus with strong dorsodistal spine not reaching distal margin of anteriorly extended carpus, distolateral margin without tooth; ventral lamina terminating

distally in small blunt tooth. Second pereopod falling far short of midlength of merus of first pereopod; dactylus about 0.44 length of propodus; propodus not widened distally. Third pereopod slender; ischium about 2.00 times as long as merus. Fourth pereopod moderately slender, overreaching antennal scale by length of dactylus and 0.30 of propodus; dactylus compressed laterally, about 0.37 times as long as propodus, propodus with distal tuft of setae; carpus 0.66 times as long as propodus; merus about ten times as long as wide, unarmed on dorsodistal margin; ischium 0.58 times as long as merus. Fifth pereopod similar to fourth, overreaching antennal scale by length of dactylus and 0.60 of propodus; ischium 0.44 times as long as merus.

Colour. Pereopods, ventral half of carapace and ventral third of abdominal somites pigmented red. Rostrum, dorsal carapace, first and sixth somites and telson green pigmented in life.

Remarks. All species of *Lissosabinea* recorded from Australia bear two median teeth on the carapace, a trait shared with congeners *L. ecarina* and *L. indica,* both known from Indonesian and now Australian waters. *L. beresfordi* shares the relatively blunt, deep rostrum with *L. arthuri* and to a lesser extent with *L. lynseyae,* the rostrum of which is less broad and spiniform distally. *L. beresfordi* is easily differentiated from *L. arthuri* by the shape of the third abdominal somite and the difference in the ventral lamina on the merus of first pereopod that terminates distally in a small blunt tooth as opposed to the prominent subacute tooth in *L. arthuri.* Also, the two median teeth on the carapace are of equal size and elevation in *L. beresfordi* but are unequal in *L. arthuri.*

Lissosabinea ecarina Komai, 2006

Figure 7.

Lissosabinea ecarina Komai, 2006: 49, figs. 10–12.
Sabinea indica – Chace, 1984: 59 (part).

Material examined. Australia, WA, north-western Australia, Mermaid L24 transect (17°45.63' S–120°42.66' E), 110 m, 19 Jun 2007 (stn SS05-2007 089), NMV J46722 (female specimen, cl. 6.0 mm).

Type locality. Kai Islands, Indonesia, 336–346 m.

Distribution. Australia, Western Australia. Western Pacific: Philippines and Indonesia; 246–472 m.

Remarks. The weakly elevated third abdominal somite and lack of a distinctly delineated median carina distinguishes *L. ecarina* from other species of the genus found in Australian waters. See Komai (2006) for further discussion on differences between *L. ecarina* and *L. indica.*

Colour. Unknown in life, faded in ethanol.

Lissosabinea arthuri sp. nov.

Figures 3–4.

Lissosabinea tridentata. —Poore, 2004: 139.
Not *Lissosabinea tridentata* Pequegnat, 1970: pp. —Dardeau & Heard, 1983: 29, fig. 15.

Type material. Holotype. Australia, Vic, (38°09.80' S, 149°41.71' E–38°10.11' S, 149°41.01' E), 260–265 m, 22 Apr 2000 (stn SS01-2000 199), NMV J59767 (female specimen, cl. 7.3 mm). Paratypes. Same locality as holotypes, NMV J52086 (2 male specimens, cl. 5.6 mm, 5.8 mm).

Etymology. Named for the second authors grandfather, Arthur C. Collins. His extensive work on Australian foraminiferans unknowingly helped inspire a career.

Type locality. Victoria, Australia, 260–265 m.

Distribution. Known only from type location.

Description. Based on holotype female.

Rostrum directed forward, laterally compressed, overreaching distal margin of first segment of antennular peduncle; distal part truncate, with deep ventral blade; dorsal surface with median ridge scattered with setae; lateral tooth strong, arising from 0.56 of rostrum; ventral margin straight, unarmed.

Carapace 1.70–1.80 times as long as wide. Middorsal carina sharp, extending nearly to posterodorsal margin of carapace, armed with two large teeth; epigastric tooth falling far short of base of rostrum arising at 0.24 of carapace length; second tooth arising from 0.57 of carapace length. Dorsal surface of carapace with few irregularly scattered setae. Antennal tooth small, not reaching anterior margin of cornea of eye. Branchiostegal tooth directed forward, falling short of anterior margin of antennal basicerite. Pterygostomian angle without tooth. Lateral face of carapace with relatively large hepatic and one post hepatic tooth, but epibranchial tooth absent; epibranchial carina conspicuous.

Fifth thoracic somite without sternal tooth in female.

Second abdominal somite smooth on dorsal surface. Third somite with middorsal carina in posterior 0.50; posterodorsal margin of somite strongly produced posteriorly, partially covering fourth somite. Sixth somite about 2.40 times as long as high; dorsal surface flat on midline. Telson with two pairs of minute dorsolateral spines; posterolateral angle with one short blunt spine and two pairs of longer spines (broken); terminal process pointed.

Antennular peduncle reaching 0.58 of antennal scale; stylocerite falling short of distal margin of first segment, spiniform. Antennal scale about 0.57 of carapace length and 2.72 times as long as wide, lateral margin straight, distal blade rounded; basicerite with ventrolateral spine reaching mid point of first segment of antennular peduncle.

Mouthparts not dissected.

First pereopod with palm about 3.20 times as long as wide; cutting edge of palm strongly oblique; pollex large, triangular, not recurved; carpus armed with two moderately large spines on lateral margin; merus with strong dorsodistal spine not reaching distal margin of anteriorly extended carpus, distolateral margin without tooth; ventral lamina terminating distally in subacute tooth. Second pereopod falling far short of mid-length of merus of first pereopod; dactylus about 0.38 length of propodus; propodus not widened distally. Third pereopod slender; ischium about 2.90 times as long as merus. Fourth pereopod moderately stout, overreaching antennal scale by length of dactylus and 0.30 of propodus; dactylus compressed laterally, about 0.45 times as long as propodus, propodus with distal tuft of setae; carpus 0.73 times as long as propodus; merus about seven times as long as wide, unarmed on dorsodistal

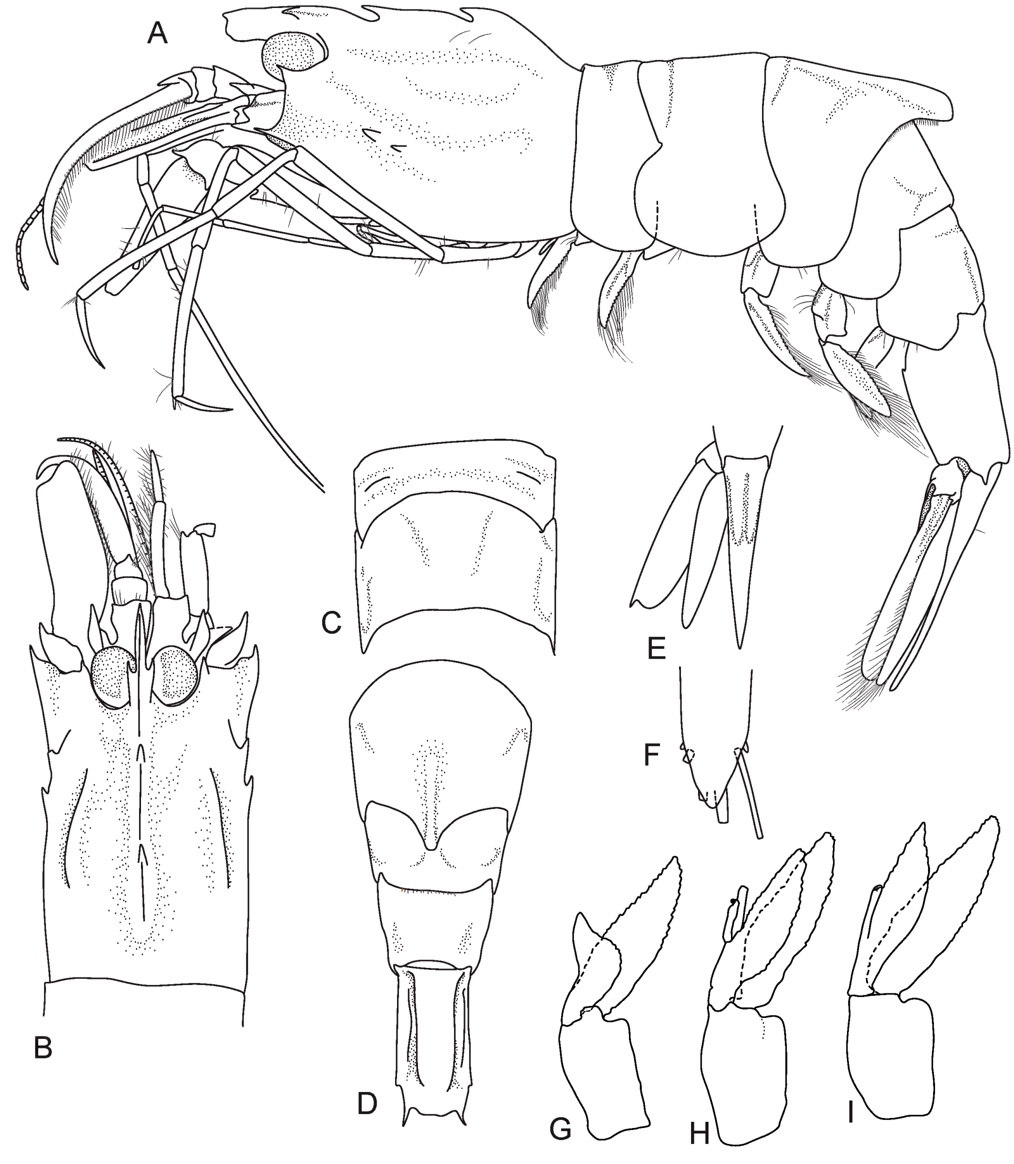

Figure 1. *Lissosabinea beresfordi* sp. nov., holotype male, cl. 7.0 mm, NMV J57989, Tasmania, Australia. A, entire animal in lateral view; B, carapace, dorsal view; C, first and second abdominal somites, dorsal view; D, third to sixth abdominal somites, dorsal view; E, telson and uropods, dorsal view; F, telson, dorsal view (magnified x 5.0 relative to F); G, left first pleopod (setae omitted); H, left second pleopod (setae omitted); I, left third pleopod (setae omitted).

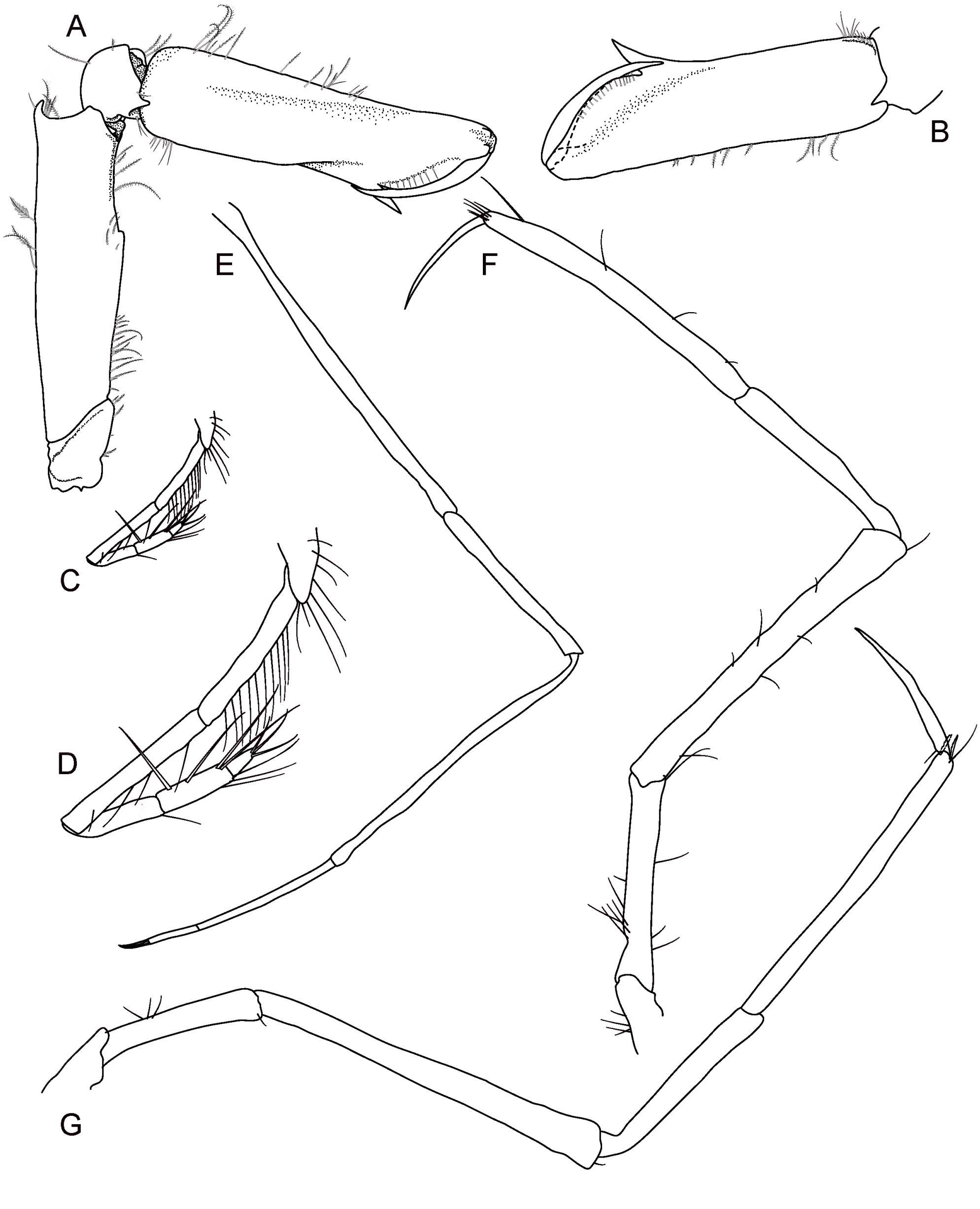

Figure 2. *Lissosabinea beresfordi* sp. nov., holotype male, (cl. 7.0 mm), NMV J57989, Tasmania, Australia. A, subchela of right first pleopod, dorsal view; B, subchela of left first pleopod, lateral view; C, left second pereopod, lateral view; D, left second pereopod, lateral view (magnified x 2.0 relative to D); E, right third pereopod, lateral view; F, left fourth pereopod, lateral view; G, left fifth pereopod, lateral view.

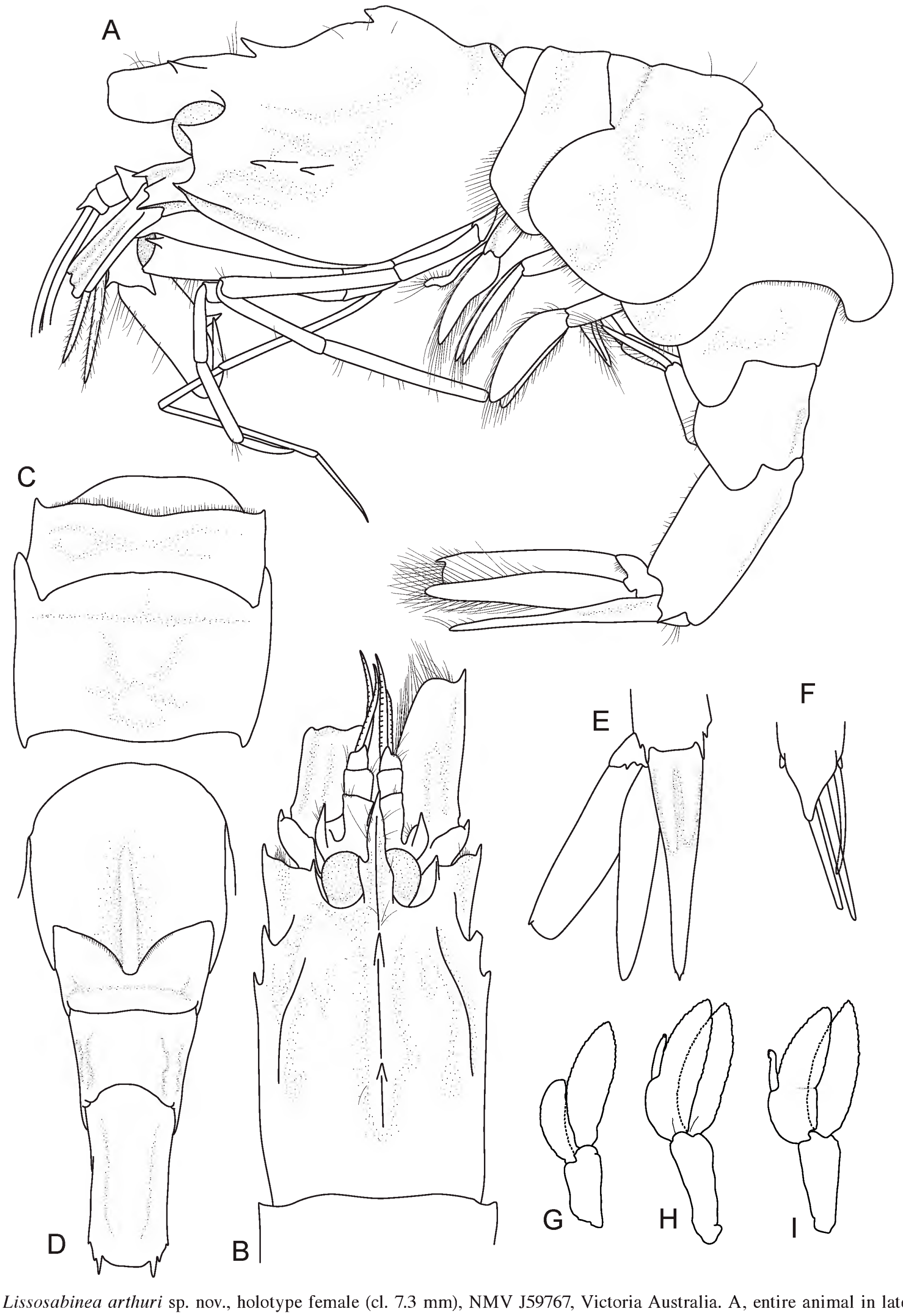

Figure 3. *Lissosabinea arthuri* sp. nov., holotype female (cl. 7.3 mm), NMV J59767, Victoria Australia. A, entire animal in lateral view; B, carapace, dorsal view; C, first and second abdominal somites, dorsal view; D, third to sixth abdominal somites, dorsal view; E, telson and uropods, dorsal view; F, telson, dorsal view (magnified x 4.2 relative to F); G, left first pleopod (setae omitted); H, left second pleopod (setae omitted); I, left third pleopod (setae omitted).

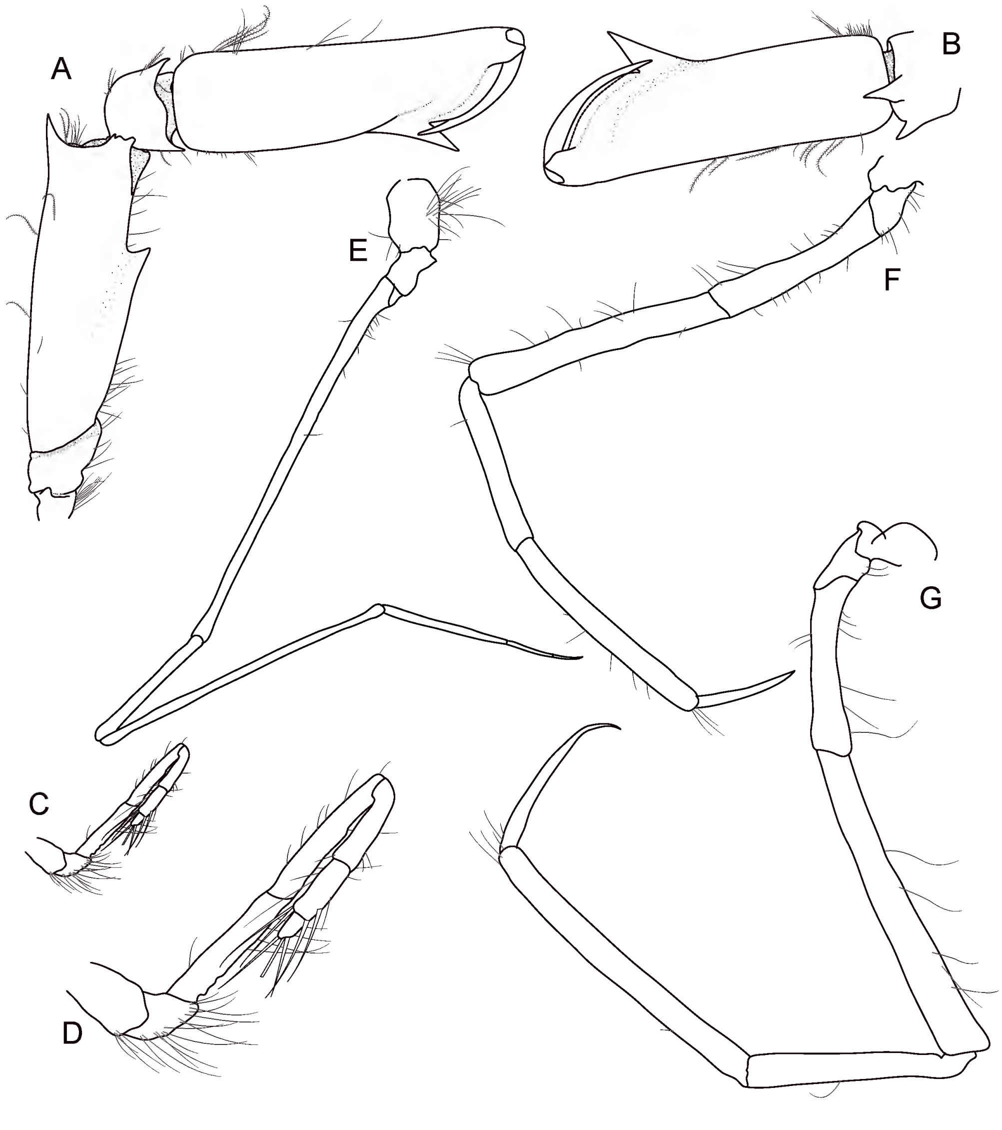

Figure 4. *Lissosabinea arthuri* sp. nov., holotype female (cl. 7.3 mm), NMV J59767, Victoria Australia. A, subchela of right first pleopod, dorsal view; B, subchela of left first pleopod, lateral view; C, left second pereopod, lateral view; D, left second pereopod, lateral view (magnified x 2.0 relative to D); E, left third pereopod, lateral view; F, left fourth pereopod, lateral view; G, right fifth pereopod, lateral view.

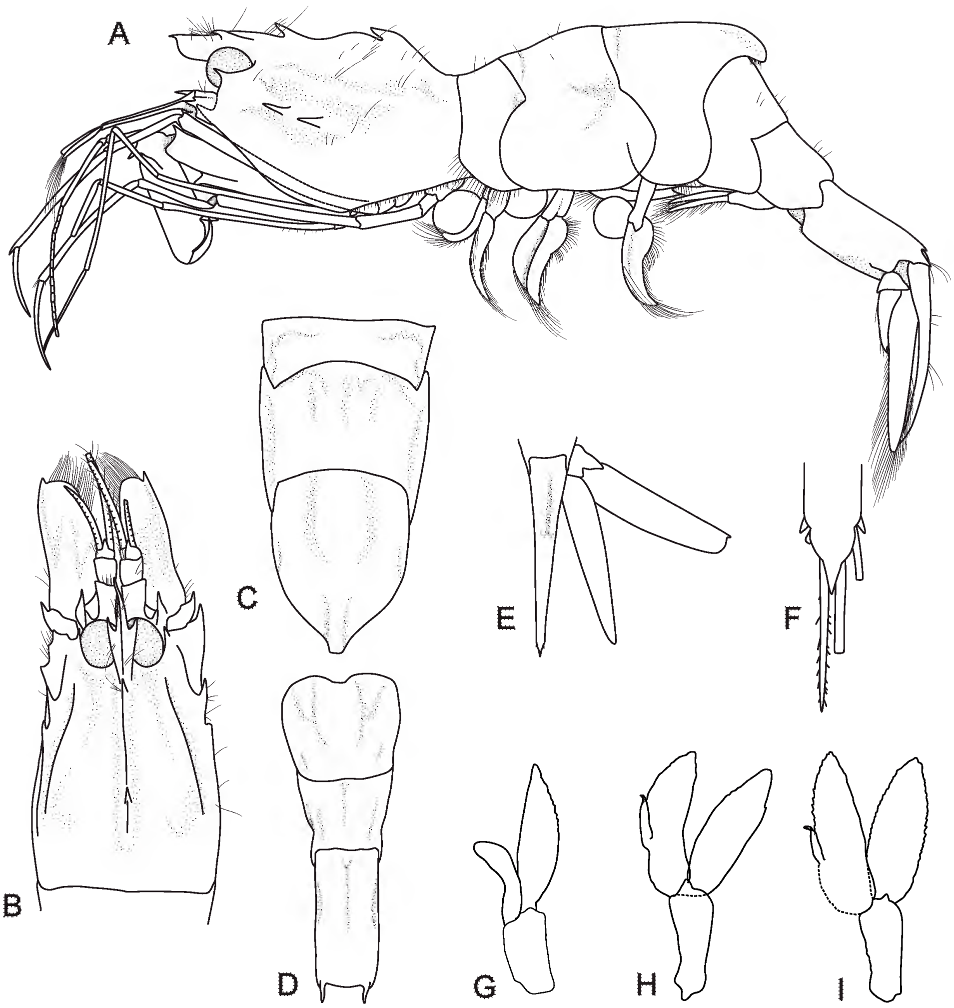

Figure 5. *Lissosabinea lynseyae* sp. nov., holotype female (cl. 5.5 mm), NMV J55492, Western Australia, off Bunbury. A, entire animal in lateral view; B, carapace, dorsal view; C, first and second abdominal somites, dorsal view; D, third to sixth abdominal somites, dorsal view; E, telson and uropods, dorsal view; F, telson, dorsal view (magnified x 4.2 relative to F); G, left first pleopod (setae omitted); H, left second pleopod (setae omitted); I, left third pleopod (setae omitted).

Figure 6. *Lissosabinea lynseyae* sp. nov., holotype female (cl. 5.5 mm), NMV J55492, Western Australia, off Bunbury. A, subchela of right first pleopod, dorsal view; B, subchela of left first pleopod, lateral view; C, left second pereopod, lateral view; D, left second pereopod, lateral view (magnified x 2.0 relative to D); E, left third pereopod, lateral view; F, left fourth pereopod, lateral view; G, left fifth pereopod, lateral view.

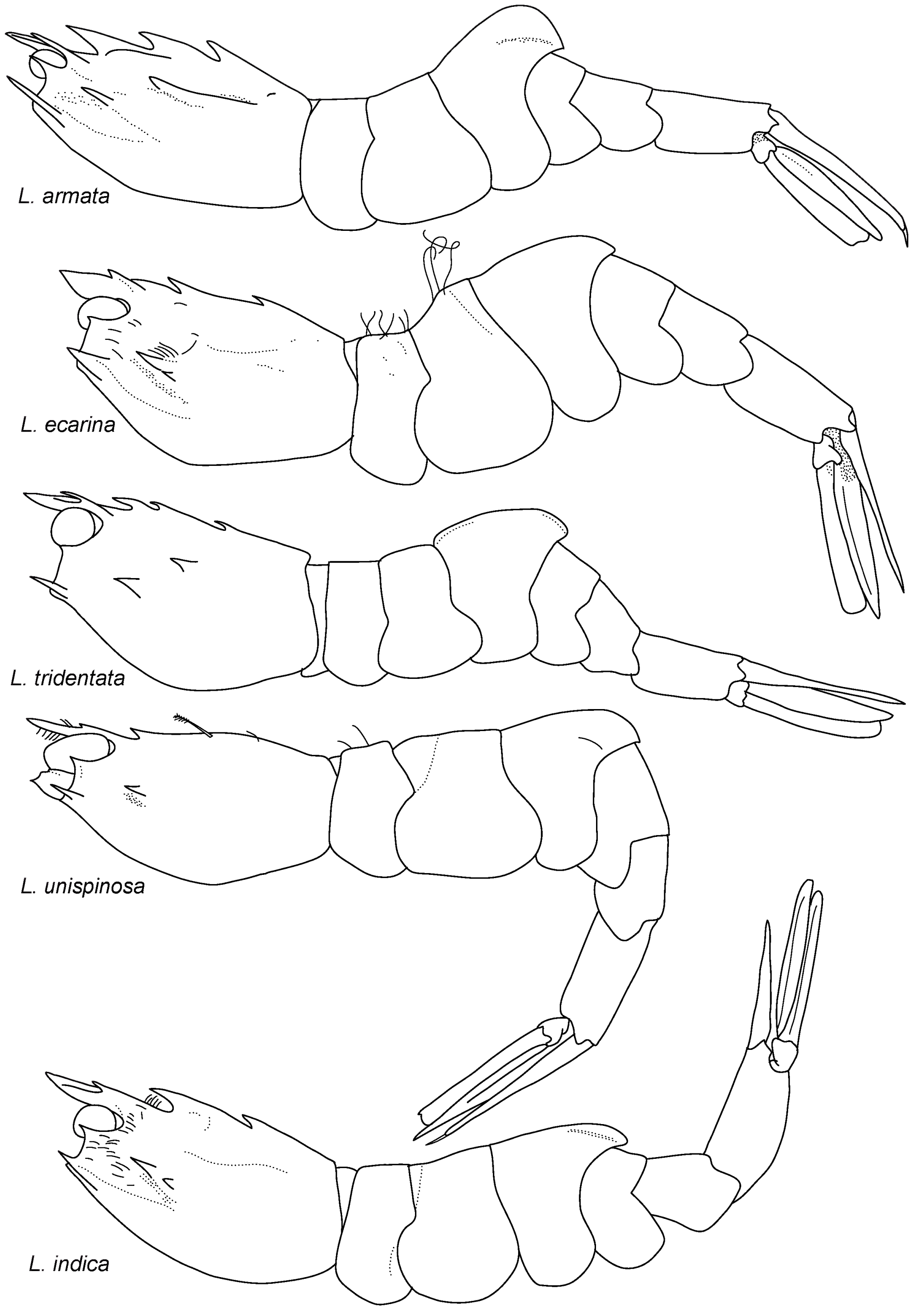

Figure 7. World species of *Lissosabinea*. Carapace and abdomen (lateral view, setae on abdomen omitted). *L. armata* redrawn from Komai, 2006 (fig. 7); *L. ecarina* redrawn from Komai, 2006 (fig. 10); *L. tridentata* redrawn from Dardeau & Heard, 1983 (fig. 15); *L. unispinosa* redrawn from Komai, 2006 (fig. 13); *L. indica* redrawn from Komai, 2006 (fig 1).

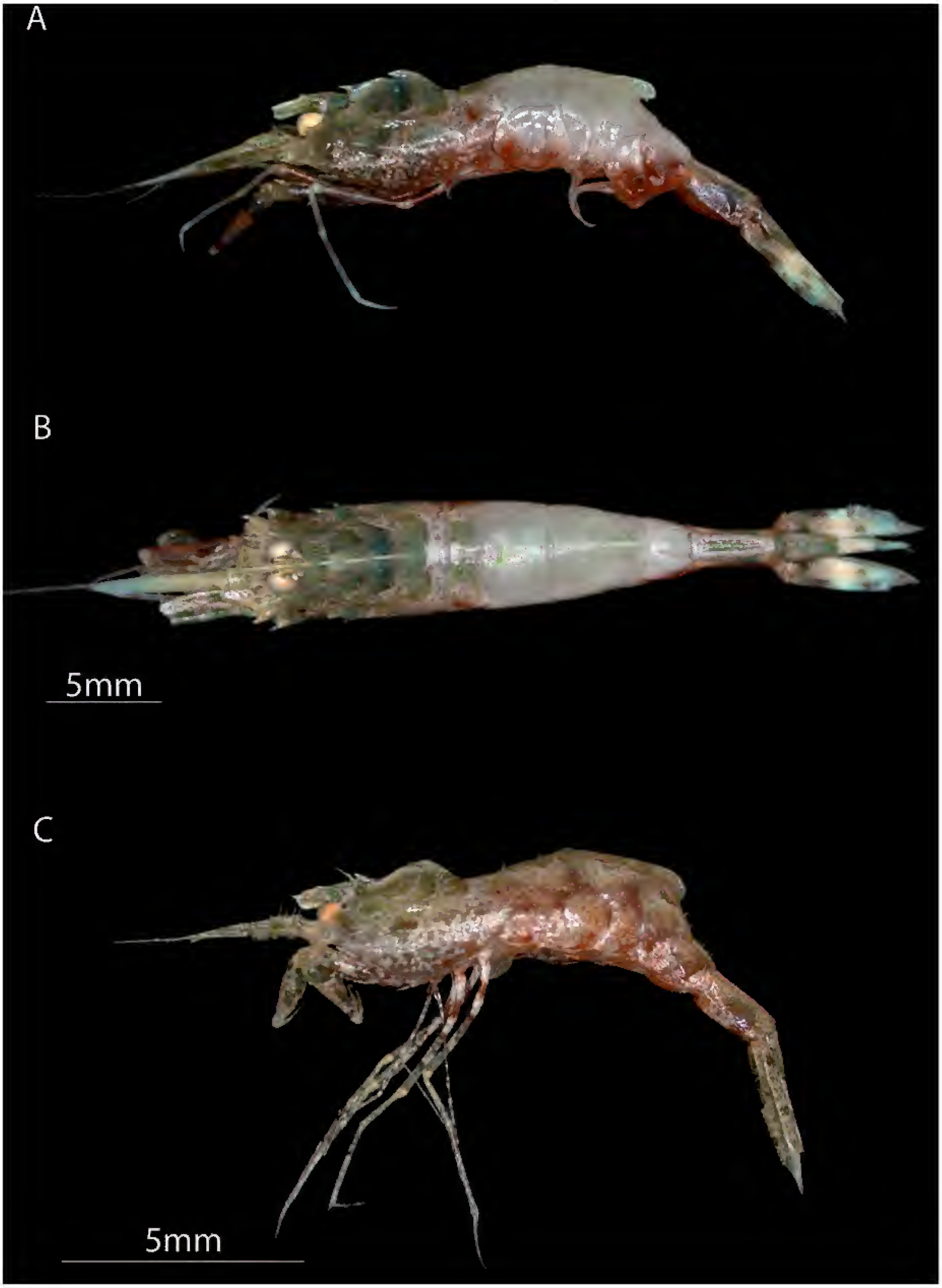

Figure 8. Live animal photographs of *Lissosabinea* copyright CSIRO. A, *Lissosabinea beresfordi* sp. nov., holotype male J57989, lateral view; B, dorsal view. C, *Lissosabinea lynseyae* sp. nov. lateral view, holotype female, cl. 5.5 mm, J54492.

margin; ischium 0.69 times as long as merus. Fifth pereopod similar to fourth, ischium 0.51 times as long as merus.

Colour. Unknown in life, faded in ethanol.

Remarks. In the paratype males the sternal tooth on the fifth thoracic somite is well developed extending beyond the base of spur on fourth somite. See remarks for *L. beresfordi* sp. nov.

Lissosabinea indica (De Man, 1918)

Figures 7, 9.

Sabinea indica De Man, 1918: 304–1920: 303, pl. 25: fig. 75), a-l–Chace, 1984: 59 (in part). –Takeda & Hanamura, 1994: 30.
Lissosabinea indica–Christoffersen, 1988: 48. –Kim & Natsukari, 2000:35 fig. 1, a-b. –Komai, 2006: 37 figs. 1–4.

Material examined. Australia, WA, north-western Australia, Mermaid L24 transect (17°45.63' S–120°42.66' E), 110 m, 19 Jun 2007 (stn SS05-2007 089), NMV J46723 (1 damaged specimen, cl. 7.7 mm). Ashmore L30 transect (12°36.00' S, 123°25.53' E–12°36.95' S, 123°26.20' E), 419 m, 8 Jul 2007 (stn SS05-2007 198), NMV J46724 (2 female specimens, cl. 6.5 mm, 8.5 mm). Mermaid L24 north transect (17°01.00' S, 119°35.46' E–17°01.82' S, 119°34.98' E), 451 m, 18 Jun 2007 (stn SS05-2007 080), NMV J46725 (1 female specimen, cl. 8.3 mm, 1 male specimen 7.8 mm).

Type locality. Tanah Djampeah Island, Indonesia (400 m).

Distribution. Australia, Western Australia. Japan, Indonesia, Coral Sea and New Caledonia; 146–700 m.

Colour. The pereopods, carapace and abdominal somites are pigmented red. The anterior carapace is green pigmented dorsally.

Remarks. See remarks for *L. ecarina*.

Lissosabinea lynseyae sp. nov.

Figures 5–6, 8.

Sabinea sp. mov 5421.—Poore *et al.*, 2008: 82.

Type material. Holotype. Australia, WA, off Bunbury (33°00.5' S, 114°59.26' E–33°00.11' S, 114°34.50' E), 421–414 m, 20 Nov 2005 (stn SS10-2005 13), WAM C42465 (female specimen, cl. 5.5 mm).

Etymology. Named for Lynsey Poore. Her enthusiastic support of Gary's crustacean research over many decades has benefited all members of the Marine Invertebrate Department.

Type locality. Bunbury, Western Australia, 414–421 m.

Distribution. Known only from type location.

Description. Based on holotype female.

Rostrum straight, directed forward, relatively broad, slightly overreaching distal margin of first segment of antennular peduncle; distal part spiniform, broadened with ventral blade; dorsal surface with low, blunt median ridge, bearing scattered setae extending onto anterior part of carapace; lateral tooth strong arising from 0.58 of rostrum; ventral margin straight, unarmed.

Carapace 1.90–2.20 times as long as wide. Middorsal carina sharp, extending nearly to posterodorsal margin of carapace, armed with two teeth; epigastric tooth falling far short of base of rostrum arising at 0.21 of carapace length; second tooth arising from 0.65 of carapace length. Dorsal surface of carapace with few irregularly scattered setae. Antennal tooth small, not reaching anterior margin of cornea of eye. Branchiostegal tooth directed forward, falling short of anterior margin of antennal basicerite. Pterygostomian angle with tooth. Lateral face of carapace with relatively large hepatic and one post hepatic tooth, but epibranchial tooth absent; epibranchial carina conspicuous.

Fifth thoracic somite without sternal tooth in spawning female.

Second abdominal somite smooth on dorsal surface. Third somite with middorsal carina in posterior 0.33; posterodorsal margin of somite moderately produced posteriorly, partially covering fourth somite. Sixth somite about 2.00 times as long as high; dorsal surface flat on midline. Telson with two pairs of minute dorsolateral spines; posterolateral angle with one short blunt spine and two pairs of longer spines (broken); terminal process acutely pointed.

Antennular peduncle reaching 0.55 of antennal scale; stylocerite not reaching distal margin of first segment. Antennal scale about 0.68 of carapace length and 2.70 times as long as wide, lateral margin slightly curved, distal blade rounded; basicerite with ventrolateral spine reaching mid point of first segment of antennular peduncle.

Mouthparts not dissected.

First pereopod with palm about 3.50 times as long as wide; cutting edge of palm strongly oblique; pollex relatively large, triangular, not recurved; carpus armed with two large spines on lateral margin; merus with very strong dorsodistal spine not overreaching distal margin of anteriorly extended carpus, distolateral margin with small blunt tooth; ventral lamina terminating distally in large acute tooth. Second pereopod not reaching mid-length of merus of first pereopod; dactylus about 0.40 length of propodus; propodus not weakly widened distally. Third pereopod slender; ischium 2.56 times as long as merus. Fourth pereopod moderately slender, overreaching antennal scale by length of dactylus and 0.70 of propodus; dactylus compressed laterally, about 0.51 times as long as propodus, propodus with distal tuft of setae; carpus 0.61 times as long as propodus; merus about eleven times as long as wide, unarmed on dorsodistal margin; ischium 0.48 times as long as merus. Fifth pereopod similar to fourth, overreaching antennal scale by length of dactylus and 0.70 of propodus; ischium 0.45 times as long as merus.

Colour. The pereopods, ventral half of carapace and ventral half of abdominal somites are pigmented red. The rostrum and dorsal carapace are green pigmented in life.

Remarks. L. lynseyae sp. nov. can be distinguished from the other species known from Australia by the shape of the third abdominal somite and the long slender dactylus of pereopod 4 which is more than half the length of the propodus.

Acknowledgments

This paper is dedicated to Dr Gary Poore, Principal Curator of Marine Biology at Museum Victoria and is part of a contribution to commemorate his 40th anniversary of studying Marine

Figure 9. Live animal photographs of *Lissosabinea indica* (De Man, 1918), female cl. 8.5 mm, J46724, copyright CSIRO.

Science in Australia.

Thanks to Alan Williams and Rudy Kloser from CSIRO Marine and Atmospheric Research (CMAR) who were largely responsible for the sampling design of the "Voyages of Discovery" research program which generated the WA and Tas proportion of the material listed in this report. Special thanks to Karen Gowlett-Holmes for permission to use the photographs of the live animals taken on board and published here.

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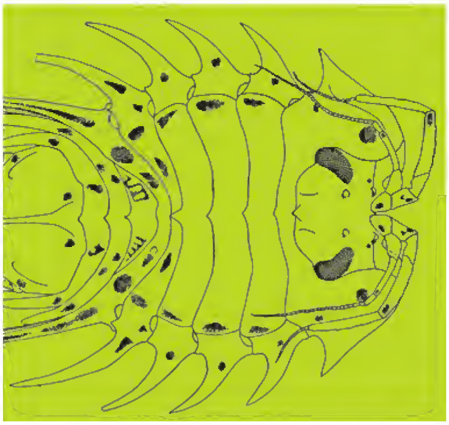

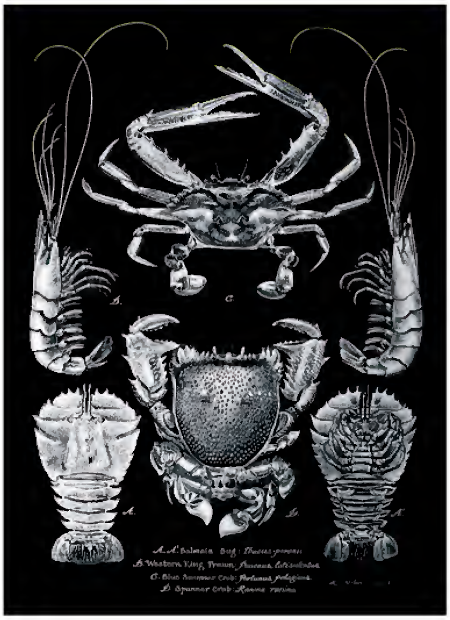

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